



ANNUAL ENVIRONMENTAL REPORT

By

Louth County Council

To

Environmental Protection Agency

For

Waste Licence Reference: W0060-03

Reporting Period January – December 2017

WHITERIVER LANDFILL SITE, COUNTY LOUTH

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CONTENTS

1	INTRODUCTION	4
1.1	REPORT PERIOD.....	4
2	WASTE ACTIVITIES CARRIED OUT AT THE FACILITY	5
3	QUANTITY AND COMPOSITION OF WASTE RECEIVED AND DISPOSED OF DURING THE REPORTING PERIOD AND EACH PREVIOUS YEAR	7
4	CALCULATED REMAINING CAPACITY OF THE FACILITY AND YEAR IN WHICH FINAL CAPACITY IS EXPECTED TO BE REACHED	7
5	METHODS OF DEPOSITION OF WASTE	8
6	SUMMARY REPORT ON EMISSIONS	8
6.1	EMISSIONS TO AIR	8
6.2	EMISSIONS TO GROUNDWATER AND SURFACE WATER.....	9
6.3	EMISSIONS TO WASTE WATER TREATMENT WORKS	9
7	SUMMARY OF RESULTS AND INTERPRETATION OF ENVIRONMENTAL MONITORING 9	
7.1	MONITORING LOCATIONS	9
7.2	TREATED LEACHATE QUALITY	12
7.3	GROUNDWATER.....	13
7.4	QUARTERLY MONITORING PARAMETERS	15
7.5	ANNUAL MONITORING PARAMETERS	15
	7.5.1 <i>Upgradient Annual Results</i>	15
	7.5.2 <i>Downgradient Annual Results</i>	16
7.6	SURFACE WATER	17
	7.6.1 <i>Lagoon/Surface Water Retention Pond</i>	20
	7.6.2 <i>Annual Results</i>	21
7.7	HYDROGEOLOGICAL RISK ASSESSMENT.....	21
7.8	GAS MONITORING.....	22
7.9	MONITORING OF EMISSIONS FROM LANDFILL GAS FLARE/ENGINES	23
7.10	NOISE MONITORING.....	23
7.11	DUST MONITORING	23
7.12	METEOROLOGICAL MONITORING.....	23
7.13	SLOPE STABILITY ASSESSMENT.....	23
7.14	ODOUR MONITORING	23
7.15	ECOLOGY MONITORING.....	24
8	RESOURCES AND ENERGY CONSUMPTION SUMMARY	24
9	PROPOSED DEVELOPMENT OF THE FACILITY AND TIMESCALE OF SUCH DEVELOPMENT	25
10	VOLUME OF LEACHATE PRODUCED AND VOLUME OF LEACHATE TANKERED OFF SITE	25

11	REPORT ON DEVELOPMENT WORKS UNDERTAKEN DURING THE REPORTING PERIOD, AND A TIMESCALE FOR THOSE PROPOSED DURING THE COMING YEAR ..	26
11.1	RESTORATION OF COMPLETED CELLS/PHASES	26
11.2	TIMESCALE FOR DEVELOPMENT WORKS PROPOSED DURING THE COMING YEAR.....	26
12	SITE SURVEY SHOWING EXISTING LEVELS OF THE FACILITY AT THE END OF THE REPORTING PERIOD	26
13	ESTIMATED ANNUAL QUANTITY OF LANDFILL GAS (LFG) EMITTED FROM THE SITE	26
14	ESTIMATED ANNUAL QUANTITY OF INDIRECT EMISSIONS TO GROUNDWATER	27
15	ASSESSMENT OF THE FEASIBILITY OF THE UTILISATION OF LANDFILL GAS AS AN ENERGY RESOURCE	27
16	MONTHLY WATER BALANCE CALCULATION AND INTERPRETATION	28
17	SCHEDULE OF ENVIRONMENTAL OBJECTIVES AND TARGETS FOR THE FORTHCOMING YEAR	28
17.1	REPORT ON THE PROGRESS TOWARDS ACHIEVEMENT OF THE ENVIRONMENTAL OBJECTIVES AND TARGETS CONTAINED IN THE PREVIOUS YEARS REPORT	28
18	FULL TITLE AND A WRITTEN SUMMARY OF ANY PROCEDURES DEVELOPED BY THE LICENSEE IN THE YEAR, WHICH RELATES TO THE FACILITY OPERATION	28
19	REPORTED INCIDENTS AND COMPLAINT SUMMARIES, CORRESPONDENCE TO/FROM EPA	28
19.1	SITE VISIT	29
19.1.1	Site Visit 10/01/2017	29
19.1.2	Site Visit 15/03/2017	29
19.1.3	Site Visit 21/08/2017	30
20	REVIEW OF NUISANCE CONTROLS	30
21	REPORT ON FINANCIAL PROVISIONS MADE UNDER THIS LICENSE, MANAGEMENT AND STAFFING STRUCTURE OF THE FACILITY AND A PROGRAMME FOR PUBLIC INFORMATION	31
22	OTHER INFORMATION.....	31
22.1	REPORT ON TRAINING OF STAFF TRAINING	31
22.2	TANK, PIPELINE AND BUND TESTING AND INSPECTION REPORT	31
22.3	UPDATES TO LANDFILL ENVIRONMENTAL MANAGEMENT PLAN (LEMP).....	32
22.4	REVIEW OF ENVIRONMENTAL LIABILITIES.....	32
22.5	REPORT ON WASTE RECOVERY.....	32
22.6	STATEMENT OF COMPLIANCE OF FACILITY WITH ANY UPDATES OF THE RELEVANT WASTE MANAGEMENT PLAN	32
22.7	STATEMENT ON THE ACHIEVEMENT OF THE WASTE ACCEPTANCE AND TREATMENT OBLIGATIONS.....	32

List of Appendices

Appendix A	Drawings
Appendix B	PRTR Reporting
Appendix C	Groundwater Monitoring Results
Appendix D	Surface Water Monitoring Results
Appendix E	Gas Monitoring Results
Appendix F	Water Balance Calculation
Appendix G	Estimated Annual Gas Yield

1 Introduction

Louth County Council holds a Waste Licence from the Environmental Protection Agency to operate Whiteriver landfill Site. This report provides a review of all data collected and the environmental aspects of operations at the site for the year 2017.

The site is located 1 km north of the main R169 Collon Rd at its junction with Whiteriver Cross, Co Louth. The facility is located in a rural setting at grid references O301450E 285625N in the townlands of Whiteriver. The northern and western boundaries adjoin two minor roads which serve scattered dwellings, whilst agricultural grazing lands adjoin the southern and eastern boundaries. The main access to the site is situated on the north western site boundary, immediately off the principle approach road. Louth County Council is the sole landowners of the site on which the landfilling activity is based.

The current waste licence (W0060-03) was issued on the 24th March 2010. The site ceased to accept municipal solid waste on the 30th August 2013 and Incinerator Bottom ash on the 20th December 2013. The site is now closed.

Facility information summary is provided in Table 1.1

Table 1.1 Facility Information Summary

AER Reporting Year	2017
Licence Register Number	(W0060-03)
Name of site	Whiteriver Landfill Site
Site Location	Whiteriver & Gunstown Townland
NACE Code	3821
Class/Classes of Activity	Landfill

1.1 Report Period

The report period for this Annual Environmental Report (AER) is from January to December 2017 and relates to the waste licence (W0060-03).

2 Waste Activities Carried Out at the Facility

In accordance with Condition 5 of the waste licence only those waste types and quantities of waste listed in the Schedule shall be disposed of at the facility unless the prior agreement of the Agency has been obtained. The maximum annual tonnage of individual waste types for disposal is listed in the Schedule of the Waste Licence and total is as follows;

Table 2.1 Maximum Annual Tonnage

Total (Tonnes per annum)	(W0060-03)
Total	96,000

* As from September 2003

The licence waste disposal activities in accordance with the Third Schedule of the waste Management Act, 1996 are restricted to those listed as follows:

- Class 1: Deposit on, in or under land (including landfill).
- Class 4: Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.
- Class 5: Specially engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment.
- Class 6: Biological treatment not referred to elsewhere in this Schedule which results in Final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1 to 10 of this Schedule.
- Class 7: Physio-chemical treatment not referred to elsewhere in this Schedule (including evaporation, drying and calcination), which results in Final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1 to 10 of this Schedule.
- Class 12: Repacking prior to submission to any activity referred to in a preceding paragraph of this schedule.

- Class 13: Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste is produced.

The licence waste disposal activities (W0060-03), in accordance with the Fourth Schedule of the Waste Management Act, 1996 are restricted to those listed as follows;

- Class 2 Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes): This activity is limited to the use of compost or similar material in the restoration of the landfill.
- Class 4 Recycling or reclamation of other inorganic materials: This activity is limited to the use of soil, subsoil and construction and demolition waste for daily cover, engineering works and the restoration of cells at the facility.
- Class 9 Use of any waste principally as a fuel or other means to generate energy: This activity is limited to the use of landfill gas as a fuel for the generation of electricity/energy.
- Class 10 The treatment of any waste on land with a consequential benefit for an agricultural activity or ecological system: This activity is limited to the use of various suitable wastes as daily or intermediate cover and in the restoration of the landfill, subject to the agreement of the Agency.
- Class 13 Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced: This activity is limited to the storage of soil, subsoil and construction and demolitions wastes at the facility prior to recovery / reuse at the facility.

3 Quantity and Composition of Waste Received and Disposed of During the Reporting Period and Each Previous Year

The quantities of waste accepted for disposal/recovery at the facility on a yearly basis are shown in Table 3.1.

Table 3.1 Waste Quantities Accepted (tonnes)¹

Waste	1996	1997	1998	1999	2000	2001	2002	2003	2004
Disposal	25,110	20,940	20,000	15,066	31,500	37,146	25,776	36,006	60,833
Recovery								5,149	9,008
Waste	2005	2006	2007	2008	2009	2010	2011	2012	2013
Disposal	80,634	82,547	70,396	84,402	53,744	50,684	75,243	89,290	54,381
Recovery	20,440	37,704	45,285	49,941	59,038	48,392	46,438	53,898	30,611

4 Calculated Remaining Capacity of the Facility and Year in which Final Capacity is Expected to be Reached

The site is now closed.

¹ Figures for 1996 to 2000 are the estimated annual waste inputs (tonnes). Waste data figures were estimated by means of assessment based on the category of vehicle depositing waste at the site.

5 Methods of Deposition of Waste

The site is now closed.

6 Summary Report on Emissions

6.1 Emissions to Air

There is no continuous air emission monitoring at Whiteriver landfill site. Periodic/non-continuous monitoring is carried out on the engine/flare. This is further discussed in Section 7.7.

In accordance with the PRTR Regulations, releases of pollutants and off site transfers of waste by facilities operating in relevant industrial sectors are to be reported by the EPA to the European E-PRTR website where the facility exceeds specified thresholds. This has been completed for Whiteriver landfill site and included in Appendix B.

There were two landfill gas flares and two engines² in operation various times at Whiteriver landfill site in 2017. Based on model predications and information from the landfill gas flares and engines the estimated net emission of methane from the flare combustion process and both surface and lateral emissions from the landfill body is 73,841 kg/year as shown on Table 6.1.

Table 6.1 Net Methane Emission

Quantities of Methane Flared and / or Utilised	T (Total) kg/Year
Total estimated methane generation (as per site model)	812,567.0
Methane flared	1,321.0
Methane utilised in engine/s	737,405.0
Net Methane Emission	73,841.0

² AFS Flare 2000m³, Haase Flare 600m³, Engine 1: 1800kw, Engine 2: 2600kw

6.2 Emissions to Groundwater and Surface Water

There are no direct discharges to groundwater from Whiteriver Landfill Site. There is one licensed emissions direct to surface water from the surface water retention pond. This is further discussed in Section 7.5.4.

6.3 Emissions to Waste Water Treatment Works

There are no licensed emissions direct to sewer from Whiteriver Landfill Site. Treated leachate is transported off site to Drogheda wastewater treatment plant. The volume tankered during the period January to December 2017 was 7,223.27 m³.

7 Summary of Results and Interpretation of Environmental Monitoring

7.1 Monitoring Locations

Monitoring was carried out at locations and at frequencies as specified in Schedule D of the waste licence (W0060-03). Monitoring points are labelled and permanent access to all monitoring points is maintained. BH13A was re drilled and BH20 was installed as a groundwater water borehole to detect leakages of the lagoon in June 2006. Private wells BH15 (Taffes), BH16 (Byrnes), and BH18 (Taffes) have been decommissioned and are no longer monitored as part of the licence requirements.

Monitoring points are detailed in Drawings IBL0069/101 and IBR1038/100. The monitoring point grid references for those available are detailed in Table 7.1. The locations of groundwater monitoring boreholes are shown in Table 7.2.

Table 7.1 Grid References of Monitoring Points

Monitoring Points	Easting	Northing
Groundwater Boreholes		
BH1	301 385	285 310
BH2	301 259	285 380
BH3	301 384	285 501
BH4	301 405	285 648
BH5A	301737	285541

Monitoring Points	Easting	Northing
BH6	301 856	285 480
BH7	301 740	285 438
BH8	301 588	285 302
BH9	301 944	285 348
BH10	301 824	285 117
BH11	302 045	285 105
BH12	301 943	285 356
BH13(redrilled)	301 824	285 126
BH14	302 045	285 119
BH17	301 293	285 180
BH19	301490	285650
BH20	301 428	285 623
Surface Water Monitoring		
SW1	301 384	285 424
SW2A	301 965	285 427
SW3	301 935	285 410
Gas Piezometers		
PZ1	301 438	285 596
PZ2	301 454	285 614
PZ3	301 496	285 628
PZ4	301 542	285 624
PZ5	301 600	285 610
PZ6	301 603	285 552
PZ7	301 603	285 512
PZ8	301 601	285 463
PZ9	301 594	285 401
PZ11	301 383	285 333
PZ12	301 382	285 381
PZ13	301 382	285 441
PZ14	301 383	285 498
PZ15	301 385	285 563

Monitoring Points	Easting	Northing
PZ16	301 410	285 579
PZ21	301 385	285 289
PZ22	301 377	285 205
PZ23	301 459	285 200
PZ24	301 490	285 201
PZ25	301 586	285 219
PZ26 PZ54	Not available	
Noise		
N1	301 336	285348
N2	135 907	270 000
N3	301345	284 739
N4	302105	284 927
N5	302 723	285 258
N6	301409	285 598
Dust		
DG1	301 395	285 372
DG2	301 596	285 374
DG3	301 960	285 421
DG4	302 058	285 043
DG5	301 648	285584
DG6	301834	285486
Leachate		
L1	301 427	285 625
L2	301 405	285 495

Table 7.2 Location of Groundwater Monitoring Boreholes

Borehole ³	Upstream/Downstream	Private Well	Overburden or Bedrock
BH1	Upstream		Overburden
BH2A	Upstream	Crawleys Private Well	Bedrock

³ Private wells BH15 (Taffes), BH16 (Byrnes), and BH18 (Taffes) have been decommissioned and are no longer monitored as part of the licence requirements.

Borehole ³	Upstream/Downstream	Private Well	Overburden or Bedrock
BH3	Upstream		Bedrock
BH4	Upstream		Bedrock
BH5	Downstream		Overburden
BH6	Downstream		Bedrock
BH9	Downstream		Bedrock
BH10	Downstream		Overburden
BH11	Downstream		Overburden
BH12	Downstream		Overburden
BH13A	Downstream		Bedrock
BH14	Downstream		Bedrock
BH17	Downstream	Holcrofts Private Well	Domestic
BH19	Upstream	McGranes Private Well	Agricultural water supply
BH20	Upstream landfill downgradient of leachate lagoon		Overburden

7.2 Treated Leachate Quality

Periodic monitoring (non-continuous) of treated leachate quality is undertaken at the facility. Leachate values recorded in the lagoon (treated leachate) were within the emission limit values as set out in the waste licence except for Sulphate in June.

Table 7.3 Treated Leachate Concentrations in 2017

Parameter	Min. Conc	Max. Conc	Limit Value
Ammoniacal Nitrogen(mg/l N)	0.601	89.3	900
BOD	11	43.6	500
COD	394	592	1,500
pH (pH units)	7.34	8.2	>6.0 and <9.0
Temperature (°C)			<25
Sulphate (mg/l)	35.7	489.88	250

7.3 Groundwater

As required under the Waste Licence, groundwater monitoring was undertaken at the borehole locations as set out in the current waste licence. The Schedules of the waste licence requires the monitoring of certain parameters on either a monthly, quarterly or annual basis; the frequencies of the monitoring of groundwater parameters currently at the closed site as agreed with the EPA are shown in Table 7.4.

Boreholes BH1, BH3 BH4, BH5A are located within the site boundary, whilst BH6 is located approximately 240m from the eastern boundary of the site. BH2A (Crawleys) is a private well located upstream of the facility. BH9, BH10, BH11, BH12, BH13A and BH14 were installed further downstream of the extension to the existing site. Monitoring is also undertaken at two private wells. These private wells are boreholes BH17 (Holcrofts) and BH19 (McGrans, Agricultural Water Supply).

Table 7.4 Groundwater Parameters Monitoring Frequencies

Quarterly		Annually	
Groundwater Level	Chloride	Metals /Non Metals	List I and II Substances
	Dissolved Oxygen	Cyanide	Residue on evaporation
	pH	Fluoride	
	Total Oxidised Carbon	Total Oxidised Nitrogen	
	Visual Inspection/ Odour	Total Alkalinity	
	Ammoniacal Nitrogen	Orthophosphate	
	Electrical Conductivity	Mercury	
	Temperature	Sulphate	

The results contained in this report are assessed as follows:

- Whiteriver Trigger Levels (WTL) agreed with the EPA (21 December 2004, 60-2/GEN09EM);
- EPA Interim Guideline Values (IGV);
- SI No 278 of 2007 European Communities (Drinking water) Regulations (DWR); and

- SI No 9 of 2010 European Communities Environmental Objectives (Groundwater) Regulations 2010 as amended Groundwater Threshold Values (GTV).

The results are presented graphically and in table format in Appendix C. The majority of parameters were below the recommended limits.

Parameters that are indicative of possible leachate contamination include Ammonia, Conductivity, Iron, Chloride and heavy metals.

Table 7.5 provides a summary of results in 2017 from groundwater monitoring boreholes throughout these monitoring periods.

Table 7.5 Summary of 2017 Results from Groundwater Monitoring Boreholes

	Units	No. of Samples	Minimum	Maximum	Mean
Alkalinity	mg/lCaCO3	15	260	494	348
Aluminium	µg/l	15	<50	2860	1044
Ammonia	mg/l N	57	<0.11	0.15	
Barium	µg/l	15	3.26	403	164
Boron	µg/l	15	7.38	23.3	15
Cadmium	µg/l	15	<0.5	<0.5	
Calcium	mg/l Ca	15	63.6	167	86
Chloride	mg/l Cl	57	10.7	81.6	22
Chromium	µg/l	15	<3	6.53	4
Conductivity	µS/cm @ 25	57	252	943	604
Copper	µg/l	15	<4	69.9	24
Cyanide	0	15	<0.05	<0.05	
D.O.	% Saturation	59	20	83	50
Fluoride	mg/l	15	0.115	0.978	1
Iron	µg/l	15	<0.024	4.95	1
Lead	µg/l	15	<0.5	<0.5	
Magnesium	mg/l Mg	15	8.72	37.8	25
Manganese	µg/l	15	1.21	2080	493
Mercury	µg/l	15	<0.02	<0.02	
Nickel	µg/l	15	1.2	16.4	6
Ortho-Phosphate	mg/l P	15	<0.07	0.5	0
pH	0	57	6.26	7.7	7
Potassium	mg/l	15	<0.10	2.3	1
Sodium	mg/l	15	9.44	40.1	21
Strontium	µg/l	15	130	510	253
Sulphate	0	15	5.04	106	25
Suspended Solids	mg/l	15	323	567	400
Temp	°C	59	8.5	13.2	12
T.O.C.	mg/l	57	<3	10	2
T.O.N	mg/l N	15	<0.06	0.58	0
Uranium	µg/l	15	<0.5	8.3	3
Vanadium	µg/l	15	<8	<8	

	Units	No. of Samples	Minimum	Maximum	Mean
Zinc	µg/l	15	1.04	983	153

7.4 Quarterly Monitoring Parameters

All ammonia as N concentrations during the reporting period were within the WTL agreed with the EPA of 0.2 mg/l N, IGV of 0.15 mg/l and the GTV of 0.175 mg/l N.

pH values analysed during the reporting period were all within the WTL of 7.0 to 8.0 with the exception BH12 (min 6.26) in 3 of the 4 monitoring dates. In addition 8 boreholes upgradient and downgradient recorded pH below 7.0 in December.

Electrical Conductivity values were all below the WTL of 800 µS/cm throughout the year except for BH9 (496 to 920 µS/cm), BH12 (802 to 943 µS/cm) and BH20 (628 to 889 µS/cm). Concentrations were below the IGV of 1000 µS/cm and GTV range of 800-1875 µS/cm.

Chloride levels exceeded the WTL of 20 mg/l in upgradient BH1 throughout the year (28.1 to 32.5 mg/l) and BH2A in March (81.6 mg/l). Concentrations exceeded the WTL in BH20 throughout the monitoring period ranging from 32.6 to 61.1 mg/l.

Elevated chloride concentrations above the WTL were recorded downgradient in BH5 and BH13 throughout the year, in BH10 in March and December and in BH17 in December. The highest concentration was recorded in BH5 in March (53 mg/l). Chloride results upgradient and downgradient results were all below the GTV of 187.5 mg/l.

All boreholes were below WTL for TOC of 10 mg/l except BH12 in March (10 mg/l).

Dissolved oxygen (DO) levels recorded during sampling onsite ranged from 20 to 83%.

7.5 Annual Monitoring Parameters

7.5.1 Upgradient Annual Results

Annual analysis for metals was undertaken on 14th December 2017. It should be noted that the analysis for metals was undertaken as total metals (includes the metals content both dissolved and present in the particulates in the water).

Alkalinity, Aluminium, Boron, Cadmium, Calcium, Chromium, Copper, Cyanide, Fluoride, Lead, Magnesium, Mercury, Nickel, Orthophosphate, Potassium, Sodium, Sulphate, Suspended Solids, TON and Vanadium concentrations were lower than the limit of detection or were below the WTL, IGV, DWR and GTV thresholds in upgradient boreholes.

Concentrations detected above the WTL and standards thresholds were as follows:

- Barium exceeded the IGV in BH1 (173 µg/l);
- Iron exceeded the IGV and DWR in BH4 (2.7 mg/l);
- Manganese exceeded the IGV and DWR in BH4 (147 µg/l);
- Zinc exceeded the WTL and IGV in BH4 (168 ug/l).

Concentrations above the limit of detection were measured for the following parameters:

- Alkalinity concentrations ranged from 269 to 347 mg/l;
- Strontium concentrations ranged from 130 to 305 ug/l;
- Uranium concentrations ranged from <0.5 to 2.31 ug/l.

7.5.2 Downgradient Annual Results

Boron, Cadmium, Calcium, Chromium, Cyanide, Lead, Magnesium, Mercury, Potassium, Sodium, Suspended Solids and TON concentrations were lower than the limit of detection or were below the WTL, IGV, DWR and GTV thresholds in downgradient boreholes.

Concentrations detected above the WTL and standards thresholds were as follows:

- Aluminium exceeded the GTV, IGV and DWR in a number of downgradient boreholes. Concentrations ranged from <2 to 2,860 µg/l;
- Barium exceeded the IGV in a number of downgradient boreholes. Concentrations ranged from 3.26 to 403 µg/l;
- Copper exceeded the WTL and IGV in BH17 (69.9 ug/l) and BH19 (31.3 µg/l);
- Fluoride exceeded the DWR in a number of downgradient boreholes, but were below the WTL and IGV. Concentrations ranged from 0.115 to 0.978 mg/l;

- Iron exceeded the IGV and DWR in a number of downgradient boreholes. Concentrations ranged from <0.019 to 4.95 mg/l;
- Manganese exceeded the IGV and DWR in a number of downgradient boreholes. Concentrations ranged from <1 to 2,080 ug/l;
- Nickel exceeded the GTV in BH9 (15.8 ug/l) and BH17 (16.4 ug/l) but were below the WTL, IGV and DWR;
- Orthophosphate exceeded the WTL and IGV in BH11 (0.22 mg/l), BH13 (0.08 mg/l) and BH19 (0.5 mg/l);
- Sulphate exceeded the WTL in BH10 (106 mg/l) but was within the GTV, IGV and DWR;
- Zinc exceeded the WTL and IGV in BH17 (983 ug/l).

Concentrations above the limit of detection were measured for the following parameters:

- Alkalinity concentrations ranged from 260 to 494 mg/l;
- Strontium concentrations ranged from 159 to 510 ug/l;
- Uranium concentrations ranged from 0.741 to 8.3 ug/l;
- Vanadium concentrations ranged from <1 to <8 ug/l.

As per the HRA (2015), the continual elevated iron and manganese exceedances are not attributed to landfill leachate. Ammonia and chloride concentrations remain unchanged downgradient and therefore other exceedances are also not attributed to landfill leachate.

7.6 Surface Water

Whiteriver Landfill Site is situated on a plateau and is located in a sub-catchment of one of the main tributaries of the White River. The White River is located approximately 4km south west of the site and it is this river, which is the main receptor for any potential surface water contamination from the site.

As required under the Waste Licence, surface water monitoring was undertaken at the station locations as set out in Table D.1.1 of the waste licence. Schedule D of the waste licence requires the monitoring of certain parameters on either a monthly, quarterly or annual

basis; the frequencies of the monitoring of surface water parameters are shown in Table 7.6 below.

Table 7.6 Surface Water Parameters Monitoring Frequencies

Quarterly	Annually
Ammoniacal Nitrogen	Metals / non metals
Biological Oxygen Demand	Mercury
Chemical Oxygen Demand	Sulphate
Chloride	Total Alkalinity
Dissolved Oxygen	Orthophosphate
Electrical Conductivity	TON
pH	
Total Suspended Solids	
Temperature	

The results contained in this report were assessed as follows:

- SI No 278 of 2007 European Communities (Drinking Water) Regulations (DWR);
- SI No 272 of 2009 European Communities Environmental Objective (Surface Water) Regulations 2009 Environmental Quality Standards (EQS); and
- SI No 294 of 1989 European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations 1989 Surface Water Quality Standards (SWQS).

These results are presented in table format in Appendix D. Table 7.7 provides a summary of results in 2017 from surface water locations.

Table 7.7 Summary of 2017 Results from Surface Water Locations

Parameters	Units	No. of Samples	Minimum	Maximum
Alkalinity	mg/l	3	202	274
Aluminium	µg/l	3	<50	206
Ammonia as N	mg/l	12	<0.1	0.37
Barium	µg/l	3	113	139
B.O.D.	mg/l	12	<2	12

Parameters	Units	No. of Samples	Minimum	Maximum
Boron	µg/l	3	<135	<135
Cadmium	µg/l	3	<0.5	<0.5
Calcium	mg/l	3	64.5	85.2
C.O.D.	mg/l	12	15	80
Chloride	mg/l	12	9.4	58.8
Chromium	µg/l	3	<3	<3
Conductivity	µS/cm @ 25	12	336	882
Copper	µg/l	3	<4	4.42
Cyanide	mg/l	3	<0.05	<0.05
D.O.	% Saturation	6	90	94
Iron	mg/l	3	0.0449	0.471
Lead	µg/l	3	<0.5	<0.5
Magnesium	mg/l	3	8.8	13
Manganese	µg/l	3	10	52.6
Mercury	µg/l	3	<0.02	<0.02
Nickel	µg/l	3	2.3	3.49
Ortho-Phosphate	mg/l	3	< 0.07	0.12
pH		12	7.5	8
Potassium	mg/l	3	1.29	13.6
Sodium	mg/l	3	8.13	11.8
Strontium	µg/l	3	138	213
Sulphate	mg/l	3	<5	47.5
Suspended Solids	mg/l	12	2	47
Temp	°C	6	8.2	8.9
T.O.N	mg/l	3	<0.08	0.71
Uranium	µg/l	3	<0.5	1.6
Vanadium	µg/l	3	<8	<8
Zinc	µg/l	3	<3	4.62

Surface water monitoring is undertaken at one location upstream at SW1 and two locations downstream of the site at SW2A and SW3. SW1 is located upstream of the landfill within a site drain along the western site boundary. SW2A is located downstream of the landfill within the northern site stream.

Chemical analyses of surface water are summarised in Appendix D.

pH readings at SW1 and SW2A were within the A1 SWQS (5.5-8.5).

Ammonia as N concentrations upstream at SW1 were above the EQS for good status total ammonia of 0.14 mg N/l on 2 of the 4 monitoring dates ranging from <0.1 to 0.37 mg/l.

Ammonia as N concentrations downstream (SW2A) were below the EQS ranging from <0.1 to <0.11 mg/l.

Upstream (SW1) BOD concentrations were above the EQS for good status (2.6 mg/l) on 3 of the 4 monitoring dates ranging from < 2 to 12 mg/l. Upstream concentrations were below the A1 SWQS of 5 mg/l except in March (5.59 mg/l). BOD concentrations downstream (SW2A) were below the EQS for high status (2.2 mg/l) and A1 SWQS ranging from <2 to 2.19 mg/l.

COD concentrations exceeded the SWQS of 40 mg/l upstream (SW1) throughout the monitoring period ranging from 52 to 80 mg/l. COD concentrations downstream (SW2A) were below the SWQS ranging from 15 to 36 mg/l.

Electrical Conductivity concentrations were below the A1 SWQS of 1000 μ S/cm upstream (SW1) and downstream (SW2A) during the monitoring period. Chloride concentrations were within the A1 SWQS of 250 mg/l upstream and downstream throughout the monitoring period.

Suspended Solids (SS) concentrations were below the A1 SWQS of 50 mg/l upstream (SW1) and downstream (SW2A) throughout the monitoring period.

Dissolved oxygen (DO) levels recorded during sampling onsite ranged from 90 to 94% at SW1 and SW2A.

7.6.1 Lagoon/Surface Water Retention Pond

SW3 is sampled from the discharge pipe from the surface water retention pond, located on the eastern boundary of the site and discharges to the stream running along the northern boundary of the site.

SW3 pH readings are within the A1 SWQS (5.5-8.5).

Ammonia as N concentrations were below the EQS for good status total ammonia of 0.14 mg N/l during the monitoring period with concentrations ranging from <0.1 and 0.136 mg/l.

The BOD concentrations in the SW3 were below the EQS for high status of 2.2 mg/l and A1 SWQS of 5 mg/l. Concentrations ranged from <2 to 2.01 mg/l.

COD concentrations were below the SWQS of 40 mg/l during the monitoring period with concentrations ranging from 26 and 33 mg/l.

Electrical Conductivity concentrations at SW3 were below the A1 SWQS of 1000 μ S/cm ranging from 336 to 579 μ S/cm. Chloride concentrations were below the A1 SWQS of 250 mg/l at SW3 ranging from 9.4 to 10.4 mg/l.

SS concentrations were below the A1 SWQS of 50 mg/l at SW3 ranging from <3 to 18 mg/l.

DO levels recorded during sampling onsite ranged from 93 to 94%.

7.6.2 Annual Results

Annual analysis was undertaken at surface water monitoring locations on 14th December 2017.

Boron, Cadmium, Calcium, Chromium, Copper, Cyanide, Lead, Magnesium, Mercury, Nickel, Orthophosphate, Sodium, Sulphate, Total Alkalinity, TON, Uranium, Vanadium and Zinc were lower than the limit of detection or were below the DWR, IGV, SWQS and EQS thresholds where applicable.

Concentrations detected above the triggers and standards limit/levels were as follows:

- Aluminium exceeded the DWR at SW1 (206 ug/l);
- Barium exceeded the A1 SWQS at SW1 (113 ug/l), SW2A (114 ug/l) and SW3 (139 ug/l);
- Iron exceeded the DWR and A1 SWQS at SW1 (0.471 mg/l);
- Manganese exceeded the DWR and A1 SWQS at SW1 (52.6 ug/l);
- Potassium exceeded the IGV at SW1 (13.6 mg/l) and SW2A (6.01 mg/l).

7.7 Hydrogeological Risk Assessment

A Hydrogeological Risk Assessment was undertaken in 2015 and a conceptual site model has been developed for the site. The report found that groundwater hydrochemistry data between 2006 and 2013 confirms that the landfill does not appear to be impacting on the

underlying aquifer. In the main, concentrations of indicative parameters of contamination are broadly lower or similar to upgradient concentrations and confirm that the landfill is not impacting on the underlying aquifer body. There are no sustained upward trends in contaminant export from the site.

Surface water hydrochemistry indicates that the landfill is not impacting on the quality of the adjacent stream which flows into White river. Downgradient sampling locations recorded concentrations of selected parameters lower or similar to upgradient sampling locations which are attributed to an upgradient agricultural source. Leachate appears to be contained within the landfill. No evidence of leachate penetrating the engineered liner or natural clay layer is evident.

7.8 Gas Monitoring

As required under the Waste Licence, landfill gas monitoring has been undertaken at the borehole locations as set out in current waste licence.

Schedule D of the waste licence requires the licensee to conduct monthly monitoring on the perimeter and in the waste of the landfill site. The trigger level for landfill gas emissions are Methane, greater than or equal to 1.0% v/v and Carbon dioxide, greater than or equal to 1.5% v/v. Landfill gas is monitored using a GA2000 infra-red analyser. These results are presented in Appendix E.

Results were below the trigger limit for Methane of 1% v/v for all perimeter locations (not in waste) during the year. From the results it can be seen that no methane was recorded in piezometers around the perimeter of the site.

Carbon dioxide levels around the perimeter of the site exceeded the licence requirements of 1.5% v/v at a number of locations during the year (PZ1, PZ2, PZ5, PZ11, PZ16, PZ28, PZ36, PZ39, PZ46, PZ49 and PZ53). The maximum level was 2.9% v/v at PZ16 in December.

Carbon dioxide was detected in a few boundary monitoring locations, similar to previous monitoring reports. These exceedances are not considered to be due to migration of landfill gas.

Two engines have been installed at the facility to generate power to the national grid. These were commissioned in June 2014. The two enclosed gas flares with a combined capacity of 2,600m³/hr remain on site.

7.9 Monitoring of Emissions from Landfill Gas Flare/Engines

Air emission monitoring was undertaken on the permanent landfill gas flare. All monitoring was carried out in accordance with Environmental Protection Agency Office of Environmental Enforcement (OEE) Air Emission Monitoring Guidance Note 2 (AG2). NO_x as NO₂, CO, VOC, HCL, HF and SO₂ emissions from the flare were within the emission limit values specified in Waste licence W060-03.

Air emission monitoring was also undertaken on the landfill gas engines. TPM, NO_x as NO₂, CO, HCL, HF and T A Luft Organics emissions from both engines were within the emission limit values specified in Waste licence W060-03 except for Total Volatile Organic Carbon (VOC) at E1 (1,758 kg/hr) and E2 (1,617 kg/hr) which exceeded the limit of 1000 kg/hr. Louth County Council is in discussions with the engine manufacturers regarding these exceedances.

7.10 Noise Monitoring

Noise monitoring is not required as the site is now closed.

7.11 Dust Monitoring

Dust monitoring has been discontinued as the site is now closed and permanently capped.

7.12 Meteorological Monitoring

Meteorological data is monitored in accordance with Schedule of the licence. This information is available on site.

7.13 Slope Stability Assessment

A slope stability assessment is currently being undertaken and will be submitted to the EPA under separate cover.

7.14 Odour Monitoring

Total Volatile Organic compound monitoring was undertaken at the site on the 10th October 2017. There were no surface emissions zones greater than or equal to 50 ppm averaged over the capped area. There were 6 surface emissions zones greater than or equal to 500

ppm around identified features. There were no surface emissions zones greater than or equal to 100 ppm instantaneous reading on open surfaces within the landfill footprint. This report has been submitted to EPA.

7.15 Ecology Monitoring

Biological sampling and a water quality assessment in accordance with EPA Q-rating methodology was undertaken at three locations on the White River adjacent to the landfill site on 19th September 2017.

The biological assessment indicates unpolluted conditions (Q4) at all of the sites monitored. The biological monitoring data contain no evidence of any significant impact on the White River from the landfill.

8 Resources and Energy Consumption Summary

Consumption of resources for the reporting period is shown in Table 8.1 below.

Table 8.1 Consumption of Resources

Parameters	Unit	Annual Total 2013	Annual Total 2014	Annual Total 2015	Annual Total 2016	Annual Total 2017
Light fuel oil (Diesel)	litres	1,998,000	1,400	1,100	0	0
Electricity used	kWh	212,000	120,000	50,000	48,200	20,653
Water	m ³		110	55	62	51

9 Proposed Development of the Facility and Timescale of Such Development

The site is now closed. Restoration of the site was completed in 2014. Landfill gas engines have been operational since July 2014. 4,147,979 kWh was generated by the engines in 2017. There is no further proposed development for the facility in 2018.

10 Volume of leachate produced and volume of leachate tankered off site

The volume of leachate transported off site to Drogheda wastewater treatment plant during the period January to December 2017 is provided in Table 10.1. A water balance calculation has been undertaken and is included in Appendix F using rainfall data from Dublin Airport⁴. This estimates the annual leachate production to be approximately 9,633 m³. This is based on using worst case scenario for infiltration of 10% for restored areas.

Table 10.1 Volume of Leachate Transported Off Site in 2017

Month	Weight Volume (m ³)
January	247.27
February	125.42
March	1289
April	908.44
May	242.95
June	608.14
July	241.82
August	158.01
September	640.3
October	1256.36
November	547.38
December	958.18
Total	7,223.27

⁴ Rainfall for 2017 from metrological station onsite not used as data set was incomplete.

11 Report on Development Works Undertaken During the Reporting Period, and a Timescale for Those Proposed During the Coming Year

11.1 Restoration of Completed Cells/Phases

The site has been fully restored. This was completed in 2014.

11.2 Timescale for Development Works Proposed During the Coming Year

There is no further proposed development for the facility in 2018.

12 Site Survey Showing Existing Levels of the Facility at the End of the Reporting Period

A complete topographical survey was carried out in June 2015. A topographical survey of the embankments and top of landfill Phases 2, 4 and 5 was undertaken in January 2018. These are available for inspection on site.

13 Estimated Annual Quantity of Landfill Gas (LFG) Emitted from the Site

The gas yield figures provided in Appendix G were calculated using GasSim Model 2.0. As can be seen from the data landfill gas production is calculated to be approximately 510 m³/hr in 2017.

There are two landfill gas flares and two engines installed at Whiteriver landfill site. The two engines are now running continuous with flare(s) providing backup when required.

The EPA landfill gas survey was also completed for 2017. The average flow rate and methane content for the engines in 2017 is provided in Table 13.1 below.

Table 13.1 Average flow rate and methane content for the engines

Engine	Average flow rate m ³ /hr	Methane content %
Engine 1	274	47.8
Engine 2	242	47.8

14 Estimated Annual Quantity of Indirect Emissions to Groundwater

The site has been developed on a containment basis, hence controlling potential discharge to groundwater. The risk of leakage is mitigated by the following;

- The relative thickness of the low permeability boulder clays constitutes a natural effective barrier to downward groundwater migration.
- Groundwater resources within the granular horizons are confined under subartesian pressure with a net upward groundwater movement.
- Leachate levels are maintained below licence limits on site.
- Leachate is pumped from the cells, to treatment lagoon and tankered off site for treatment.

There were no direct discharges to groundwater or surface water. The volume of leachate transported off site to Drogheda wastewater treatment plant during the period January to December 2017 was 7,233.27 m³. A water balance calculation has been undertaken. This estimates the annual leachate production to be approximately 9,633 m³ as discussed in Section 10.

15 Assessment of the Feasibility of the Utilisation of Landfill Gas as an Energy Resource

Two engines (0.80 Mw and 0.60 Mw) have been installed at the facility to generate power to the national grid. These were commissioned in June 2014.

16 Monthly Water Balance Calculation and Interpretation

A water balance calculation has been undertaken and is included in Appendix F. This estimates the annual leachate production to be approximately 9,633 m³. The actual quantity of leachate tankered from the site was 7,223.27 m³.

17 Schedule of Environmental Objectives and Targets for the Forthcoming Year

17.1 Report on the Progress Towards Achievement of the Environmental Objectives and Targets Contained in the Previous Years Report

The objective for the site for 2018 is to ensure the site complies with the waste licence conditions.

18 Full Title and a Written Summary of Any Procedures Developed by the Licensee in the Year, which Relates to the Facility Operation

As part of the Environmental Management System (EMS) procedures have been developed for the site. Operational procedures ensure that the routine operational tasks related to the environmental management of the facility are undertaken in a satisfactory manner as required to maintain effective control of the environmental aspects of the facility. The Fire Prevention Plan was updated on 15th November 2017. This is available for inspection on site.

19 Reported Incidents and Complaint Summaries, Correspondence to/from EPA

Minor incidents (2 incidents) were reported for 2017 in relation to a carbon dioxide levels in perimeter landfill gas piezometers. Quarterly incidents were due to the presence of chloride in groundwater (2 incidents) and sulphate in leachate (2 incidents) which did not cause a significant environmental issue. No complaints were received in 2017.

19.1 Site Visit

A number of site visits were undertaken by EPA in 2017.

19.1.1 Site Visit 10/01/2017

A site visit was undertaken by the EPA on 10/01/2017 (SV11509). Water samples were collected for analyses at BH1, BH5, BH12 and SW1. All groundwater results were below the WTL, IGV, DWR and GTV thresholds or were lower than the limit of detection except conductivity in BH12 (867 $\mu\text{S}/\text{cm}$) which exceeded the WTL. SW1 results were below SWQS and EQS-MAC or were lower than the limit of detection.

19.1.2 Site Visit 15/03/2017

A site visit was undertaken by the EPA on 15/03/2017 (SV11119). The following actions are to be undertaken:

- The licensee shall create a Fire Prevention Plan, without delay. All current fire prevention measures in place at the landfill shall be recorded in this document.
- In the event of a trigger level breach incident, the licensee shall notify the Agency as soon as practicable and in any case not later than 10:00 hrs the following working day after the occurrence of any incident.

A number of observations were made on the day of the site visit including:

- A wellhead connection to a feed line was severed in Phase 2, Cell 2A and in Phase V, Cell 2B, photographs DSCF1007 and DSCF1009 refer. The licensee indicated that the connections were sealed off and that repairs have being scheduled.
- In Phase II and Phase III, some gas well bentonite seals were defective and some were causing flooding due to a deficit of drainage in the well, photograph DSCF1002 refers.
- In Phase II and Phase III, partial subsidence of the cap was evidence through visible slope differentials in areas of the cell, photograph DSCF1003 refers.
- In Phase II and Phase III older butterfly type valves are in use for gas wells.
- Some gas monitoring wells at the facility remains without ports on both sides of the valves.

The licensee indicated that regrading and wellhead repair works were scheduled for the summer months of 2017 in the areas of Phase I, II and III in particular.

The following actions are to be undertaken:

- The licensee shall repair the well head connection to the pipeline, without delay. The licensee shall ensure the maintenance of gas pipework and wells in a safe and fully operational manner at all times. The licensee shall progress with the regrading works in the Phase II and III areas. The licensee is reminded of the licence requirement for Specified Engineering Work approval in accordance with Condition 3.2, Schedule B for engineering works at the facility.

19.1.3 Site Visit 21/08/2017

A site visit was undertaken by the EPA on 21/08/2017 (SV11584). Water samples were collected for analyses at BH1, BH5, BH12 and SW1. All groundwater results were below the WTL, IGV, DWR and GTV thresholds or were lower than the limit of detection except conductivity in BH12 (973 $\mu\text{S}/\text{cm}$) which exceeded the WTL. SW1 results were below SWQS and EQS-MAC or were lower than the limit of detection except for Ammonia (3.6 mg/l), BOD (16 mg/l) and COD (62 mg/l). SW1 is located upstream of the site.

20 Review of Nuisance Controls

The site ceased to accept municipal solid waste on the 30th of August 2013 and Incinerator Bottom ash on the 20th of December 2013. The site is now closed and has been restored.

Odour monitoring is currently still being undertaken at the facility. Total Volatile Organic compound monitoring was undertaken at the site on 10th October 2017.

21 Report on Financial Provisions Made Under this License, Management and Staffing Structure of the Facility and a Programme for Public Information

Louth County Council being a local authority is able to provide the necessary finances to ensure the proper management development and restoration of Whiteriver Landfill Site.

Overall responsibility for the ongoing operations of the landfill site is held by a Senior Engineer assigned to the Environmental Section of Louth County Council. The site ceased to accept municipal solid waste on the 30th of August 2013 and Incinerator Bottom ash on the 20th of December 2013.

Management Structure for the closed site is as follows. This is the present status although it may be changed at a future stage.

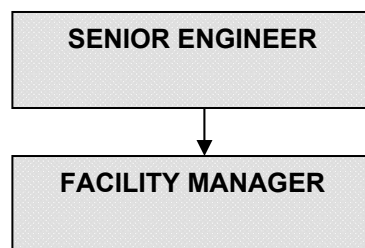


Figure 21.1 Management Structure at Whiteriver Landfill Site

22 Other Information

22.1 Report on Training of Staff Training

No staff training was undertaken in 2017. The site is now closed.

22.2 Tank, Pipeline and Bund Testing and Inspection Report

There are no tanks, pipeline or bund inspection undertaken on site.

22.3 Updates to Landfill Environmental Management Plan (LEMP)

This was last reviewed in October/November 2010 and is available for inspection on site.

22.4 Review of Environmental Liabilities

An Environmental Liabilities Risk Assessment (ELRA) has been completed for the site. This was submitted to EPA in June 2011. The level of financial cover has been agreed with the Agency; however the method of putting in place the financial provision has yet to be agreed.

22.5 Report on Waste Recovery

No wastes were recovered on site. The site is now closed.

22.6 Statement of Compliance of Facility with any Updates of the Relevant Waste Management Plan

The number of waste management planning regions has been reduced from 10 regions to 3 (Connacht-Ulster, Eastern-Midland, and Southern). Louth is now part of the Eastern-Midland Region of which Dublin City Council is the lead authority.

This Plan will set the key objectives and targets for the Region to be achieved over the next 6 years. The Plan was launched on May 14th 2015.

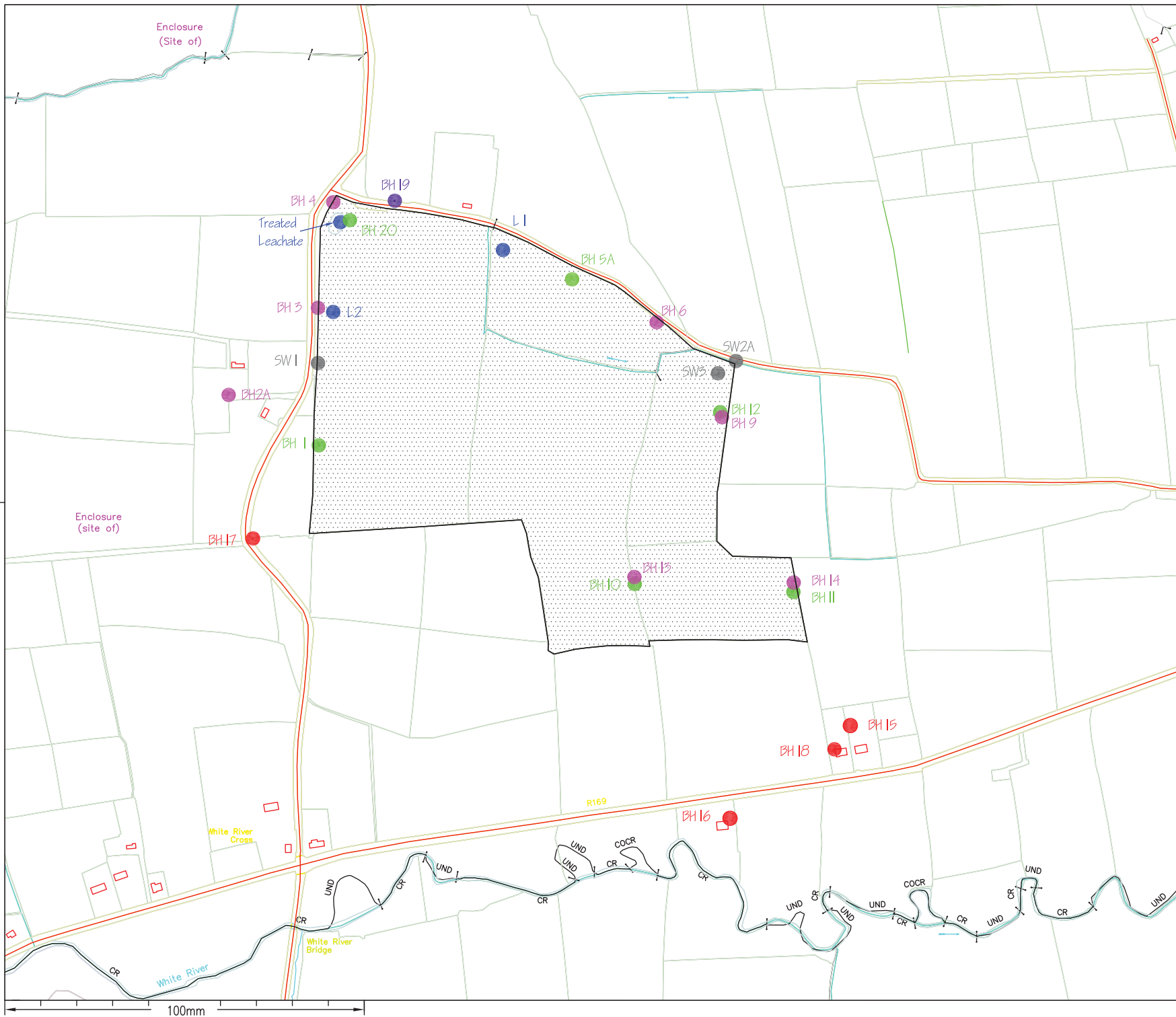
Whiteriver landfill site is listed under local authority landfill capacity closed in the region.

22.7 Statement on the Achievement of the Waste Acceptance and Treatment Obligations

The site is now closed.

Appendix A

Drawings



NOTES

1. VERIFYING DIMENSIONS. THE CONTRACTOR SHALL VERIFY DIMENSIONS AGAINST SUCH OTHER DRAWINGS OR SITE CONDITIONS AS PERTAIN TO THIS PART OF THE WORK.
2. SERVICES. APPROVED OPENINGS FOR SERVICES THROUGH THE STRUCTURE ARE INCORPORATED ON THE DRAWINGS. ANY ADDITIONAL OPENINGS OF A MINOR NATURE REQUIRED BY THE MAIN CONTRACTOR OR HIS SUBCONTRACTORS MUST BE SUBMITTED ON A DRAWING FOR APPROVAL BEFORE WORK COMMENCES.
3. DATUM
4. KEY
INCLUDES ORDNANCE SURVEY IRELAND DATA REPRODUCED UNDER OSI LICENCE NUMBER 2003/07CCMA/LOUTH LOCAL AUTHORITIES. UNAUTHORISED REPRODUCTION INFRINGES ORDNANCE SURVEY IRELAND AND GOVERNMENT OF IRELAND COPYRIGHT. © ORDNANCE SURVEY IRELAND, 2006.

- BH15 Groundwater well (Domestic)
- BH1 Groundwater monitoring boreholes (Overbunden)
- BH4 Groundwater monitoring boreholes (Bedrock)
- SW1 Surfacewater monitoring location points
- L1 Leachate monitoring points
- BH19 Agricultural water supply

D	Private well decommissioned removed.	AMB Jul '12	AmcG Jul '12
REV	DESCRIPTION	BY DATE	CHECK DATE

DRAWN BY RP DATE NOV '06	CHECK BY AmcG DATE NOV '06	APPROVED D.D DATE NOV '06
PLOT SCALE 1:5000	SCHEDULES	SHEET SIZE A3

CLIENT
LOUTH COUNTY COUNCIL

PROJECT
WHITERIVER LANDFILL SITE

TITLE
MONITORING BOREHOLES

RPS Consulting Engineers
 TEL: 074 91 61927 www.rpsgroup.com/ireland FAX: 074 91 61928
 THE ENTERPRISE FUND BUSINESS CENTRE, BALLYRAINE, LETTERKENNY, Co. DONEGAL

ARCHITECT	DWG. STATUS
DRAWING No. IBL0069/101	PRELIM.
REVISION A B C D	TENDER
	CONST.
	RECORD ●



NOTES

- Verifying Dimensions.
The contractor shall verify dimensions against such other drawings or site conditions as pertain to this part of the work.
- Existing Services.
Any information concerning the location of existing services indicated on this drawing is intended for general guidance only. It shall be the responsibility of the contractor to determine and verify the exact horizontal and vertical alignment of all cables, pipes, etc., (both underground and overhead) before work commences.
- Issue of Drawings.
Hard copies, dwf and pdf will form a controlled issue of the drawing. All other formats (img, dxf etc.) are deemed to be an uncontrolled issue and any work carried out based on these files is at the recipient's own risk. RPS will not accept any responsibility for any errors arising from the use of these files, either by human error by the recipient, listing of un-dimensioned measurements, compatibility issues with the recipient's software, and any errors arising when these files are used to aid the recipient's drawing production, or setting out on site.
- DATUM:
- KEYS
INCLUDES ORDNANCE SURVEY IRELAND DATA REPRODUCED UNDER OSI LICENCE NUMBER 2003/07/COMAILOUTH LOCAL AUTHORITIES. UNAUTHORISED REPRODUCTION INFRINGES ORDNANCE SURVEY IRELAND AND GOVERNMENT OF IRELAND COPYRIGHT, © ORDNANCE SURVEY IRELAND, 2007.

PZ 01 Landfill Gas Piezometer

rev	amendments	drawn date	checked date

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Client
LOUTH COUNTY COUNCIL

Project
Whiteriver Landfill Site

Title
Landfill Gas Piezometer

Architect

Drawing Status	Sheet Size	Drawing Scale
Preliminary	A3	1:2500

Drawing Number	Rev
IBR0138/100	0

50m SCALE 1:2500

Drawn By / Date	Checked By / Date	Approved By / Date
AMB Mar '10	AMcG Mar '10	DD Mar '10

Appendix B

PRTR Reporting



| PRTR# : W0060 | Facility Name : Whiteriver Landfill Site | Filename : W0060_2017.xls | Return Year : 2017 |

[Guidance to completing the PRTR workbook](#)

PRTR Returns Workbook

Version 1.1.19

REFERENCE YEAR	2017
-----------------------	------

1. FACILITY IDENTIFICATION

Parent Company Name	Louth County Council
Facility Name	Whiteriver Landfill Site
PRTR Identification Number	W0060
Licence Number	W0060-03

Classes of Activity

No.	class_name
-	Refer to PRTR class activities below

Address 1	Whiteriver & Gunstown Townland
Address 2	Dunleer
Address 3	
Address 4	
Country	Louth
Coordinates of Location	Ireland
River Basin District	-6.52774 53.6647
NACE Code	GBNIIENB
Main Economic Activity	3821
AER Returns Contact Name	Treatment and disposal of non-hazardous waste
AER Returns Contact Email Address	Sean Callaghan
AER Returns Contact Position	sean.callaghan@louthcoco.ie
AER Returns Contact Telephone Number	Executive Scientist
AER Returns Contact Mobile Phone Number	042 9392977
AER Returns Contact Fax Number	086 3837216
Production Volume	042 9336761
Production Volume Units	0.0
Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	2
User Feedback/Comments	50% variance in Releases to Air due to incorrect Chlorofluorocarbons (CFCs) value reported in 2016 (20 kg) should have been 9.88 kg and incorrect Hydrofluorocarbons (HFCs) value reported in 2016 (14.5 kg) should have been 7.42 kg. 1,1,1-trichloroethane should not have been reported in 2016 (13.2 kg) as the correct value was below the reporting threshold of 10 kg.
Web Address	

2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name
5(d)	Landfills
5(c)	Installations for the disposal of non-hazardous waste
5(d)	Landfills
50.1	General

3. SOLVENTS REGULATIONS (S.I. No. 543 of 2002)

Is it applicable?	
Have you been granted an exemption ?	
If applicable which activity class applies (as per Schedule 2 of the regulations) ?	
Is the reduction scheme compliance route being used ?	

4. WASTE IMPORTED/ACCEPTED ONTO SITE

[Guidance on waste imported/accepted onto site](#)

Do you import/accept waste onto your site for on-site treatment (either recovery or disposal activities) ?	
--	--

4.1 RELEASES TO AIR

[Link to previous years emissions data](#)

| PRTR# : W0060 | Facility Name : Whiteriver Landfill Site | Filename : W0060_2017.xls | Return Year : 2017 |

19/04/2018 16:57

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

POLLUTANT		METHOD			QUANTITY			
No. Annex II	Name	M/C/E	Method Used		Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
			Method Code	Designation or Description				
01	Methane (CH4)	C	OTH	Gassim model	0.0	73841.0	0.0	73841.0
04	Hydro-fluorocarbons (HFCs)	C	OTH	Gassim model	0.0	5.44	0.0	5.44

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING PRTR POLLUTANTS

POLLUTANT		METHOD			QUANTITY			
No. Annex II	Name	M/C/E	Method Used		Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
			Method Code	Designation or Description				
15	Chlorofluorocarbons (CFCs)	C	OTH	Gassim model	0.0	7.55	0.0	7.55

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION C : REMAINING POLLUTANT EMISSIONS (As required in your Licence)

POLLUTANT		METHOD			QUANTITY			
Pollutant No.	Name	M/C/E	Method Used		Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
			Method Code	Designation or Description				
					0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

Additional Data Requested from Landfill operators

For the purposes of the National Inventory on Greenhouse Gases, landfill operators are requested to provide summary data on landfill gas (Methane) flared or utilised on their facilities to accompany the figures for total methane generated. Operators should only report their Net methane (CH4) emission to the environment under T(total) KG/yr for Section A: Sector specific PRTR pollutants above. Please complete the table below:

Landfill:	Whiteriver Landfill Site					
Please enter summary data on the quantities of methane flared and / or utilised	T (Total) kg/Year	M/C/E	Method Used		Facility Total Capacity m3 per hour	
			Method Code	Designation or Description		
	Total estimated methane generation (as per site model)	812567.0	C	Gassim	Gassim Lite	N/A
	Methane flared	1321.0	C	measured	measured	0.0 (Total Flaring Capacity)
	Methane utilised in engine/s	737405.0	C	measured	measured	0.0 (Total Utilising Capacity)
Net methane emission (as reported in Section A above)	73841.0	C	measured	measured	N/A	

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

| PRTR# : W0060 | Facility Name : Whiteriver Landfill Site | Filename : W0060_2017.xls | Return Year : 2017 |

19/04/2018 16:58

Please enter all quantities on this sheet in Tonnes

3

Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Method Used		Location of Treatment	Haz Waste - Name and Licence/Permit No of Next Destination Facility Non-Haz Waste: Name and Licence/Permit No of Recover/Disposer	Haz Waste : Address of Next Destination Facility Non-Haz Waste: Address of Recover/Disposer	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
						M/C/E	Method Used					
Within the Country	19 07 03	No	7223.27 in 19 07 02	landfill leachate other than those mentioned	D9	M	Weighed	Offsite in Ireland	EPS ..	Marsh Road,Drogheda,Co. Louth,,Ireland		

* Select a row by double-clicking the Description of Waste then click the delete button

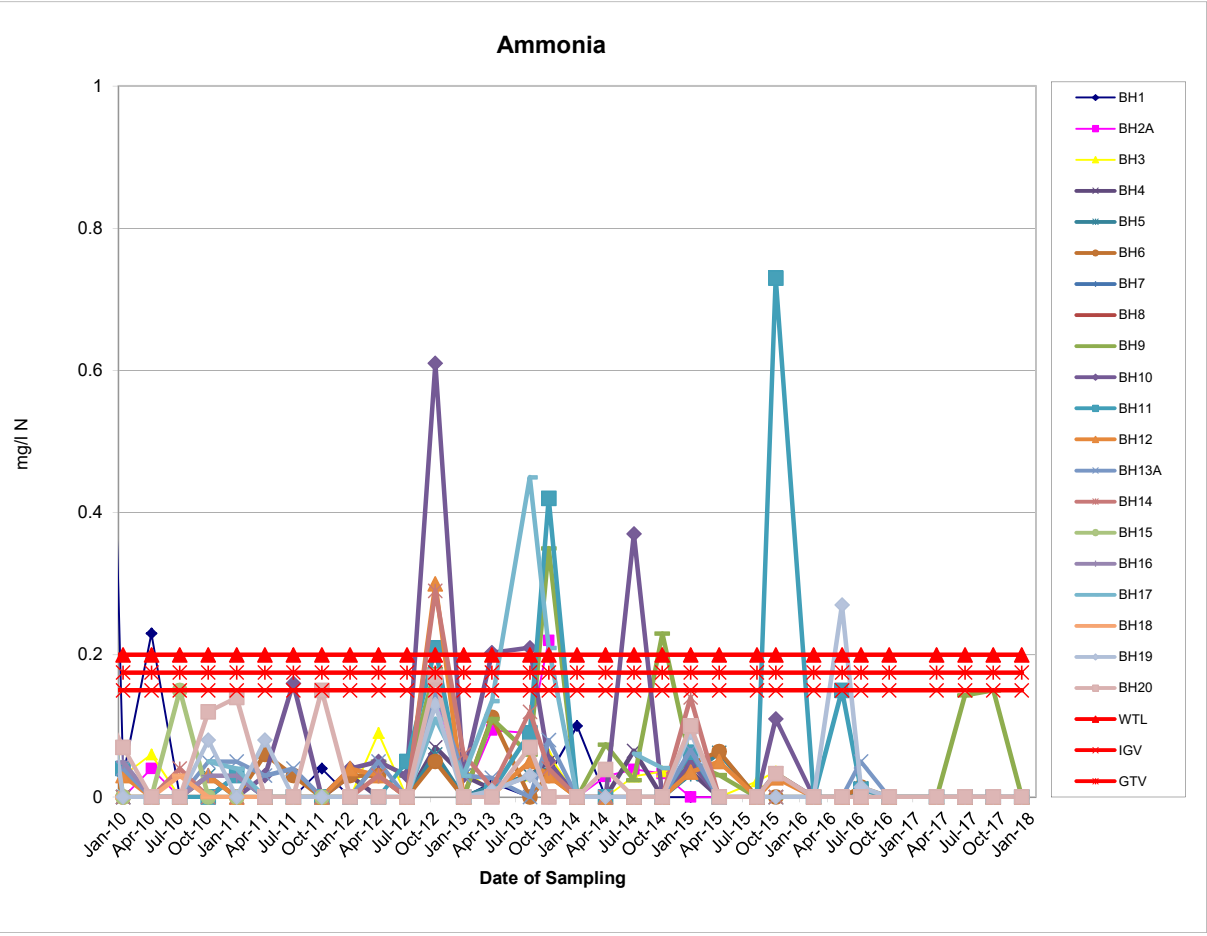
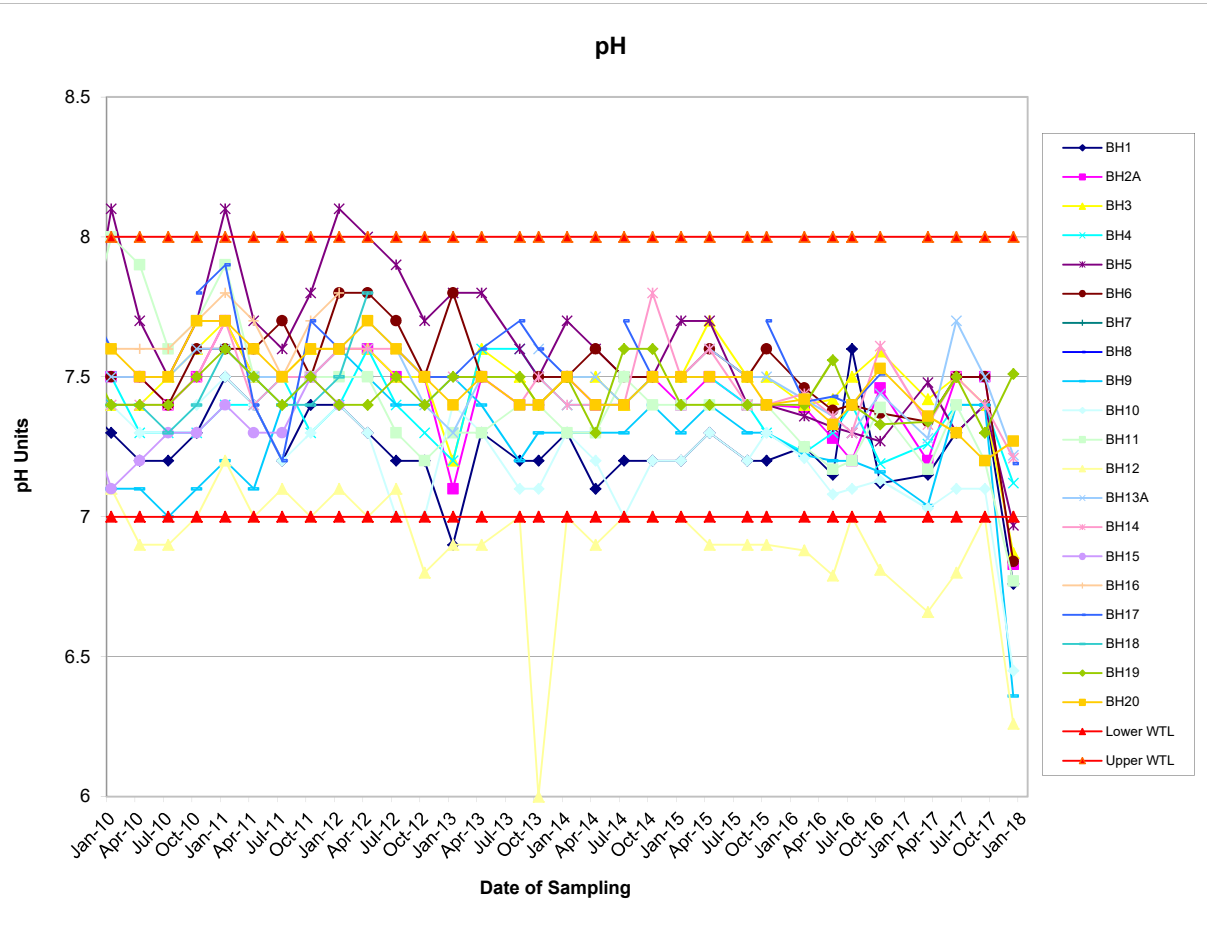
Appendix C

Groundwater Monitoring Results

PARAMETERS		Whiteriver Landfill Site																																				
		GROUNDWATER QUALITY																																				
Monitoring Point		RESULTS																																				
		UPSTREAM BEDROCK CRAWLEYS PRIVATE WELL- POTABLE SOURCE																																				
Units		Trigger Level	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date								
Alkalinity	mg/l CaCO3	NAC			324																																	
Aluminium	µg/l																																					
Ammonia	mg/l N	0.2	0.05	<0.03	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.094	0.09	0.22	<0.020	0.029	0.039	0.033	<0.020	<0.020	<0.020	<0.2	<0.11	<0.01	<0.11	<0.11								
Antimony	µg/l															<0.5				<1.0																		
Arsenic	µg/l															<0.5				<1.0																		
Barium	µg/l				<1											0.62				<1.0																		
Beryllium	µg/l															<0.5				<1.0																		
B.O.D.	mg/l O2																																					
Boron	µg/l	1000			12.5				15.3							11				15								9.68		<135								
Cadmium	µg/l	5			<0.1				<0.1							<0.1				<0.020										<0.5								
Calcium	mg/l Ca	200			63.33				69.74							65.21				62.35										65.65	64.7							
C.O.D.	mg/l O2							nm																														
Chloride	mg/l Cl	20	16	16	16	17	17	16	16	15	16	15	16	16	16	16	16	17	17	14	16	16	16	17	16	19	15.6	16.7	16.34	16.3	16.2	81.6	15.8	16.8	16.5			
Chromium	µg/l	30			<1				<0.5							<0.5				<1.0										<2.14	<3			<3				
Cobalt	µg/l															<0.5				<1.0										<0.02								
Coliform Bacteria	no/100ml		34	0	7	18										20	0			1	1	61			nm													
Conductivity	µS/cm @ 25	800	611	616	615	610	549	627	608	610	657	632	614	674	644	611	609	614	613	615	612	610	613	587	591	614	611	634	625	558	619			619				
Copper	µg/l	30			1.8				1.5							0.7				1.32											2.877				4			
Cyanide	mg/l	0.01			<0.05				<0.05							<0.05				<0.05										<5				<0.05				
D.O.	% Saturation		33	31	54	25	20	43	26	37	33	30	28	33	19	26	24	23	20	29	19	40	27	21	34	20	20	7.1		18			42	22.0	41	20		
E. Coll	no/100ml		0	0	0	0										1	0								nm													
Fluoride	mg/l	1			<0.150				<0.150							<0.150				0.11										<0.20			0.21		0.582			
Iron	µg/l				<10				<10							<10				37.66										<10.0			6.715		<0.024			
Lead	µg/l	10			<1				<0.5							<0.5				<1.0										<0.02			<0.5		<0.024			
Magnesium	mg/l Mg	50			31.3				34.16							31.42				30.6										32.44			25.6		34.3			
Manganese	µg/l				2.5				2.9							2.5				5										<5.0		1.65		3.01		2.7		
Mercury	µg/l	1			<0.1				<0.05							<0.05				<0.050										<0.020			<0.04		<0.02			
Molybdenum (µg/l)																<0.5				<1.0										<5								
Nickel	µg/l	20			<1				<0.5							<0.5				0.51										<1.0		<0.14		0.677		1.2		
Ortho-Phosphate	mg/l P	0.03			<0.02				<0.02							<0.02				0.005										<0.010			<0.005		<0.07			
pH		>7 or <8	7.5	7.5	7.5	7.4	7.5	7.7	7.5	7.5	7.5	7.6	7.6	7.5	7.5	7.1	7.5	7.4	7.4	7.5	7.4	7.4	7.5	7.4	7.4	7.4	7.4	7.39	7.28	7.2	7.46			7.2	7.5	7.5	6.83	
Potassium	mg/l	5			1.06				1.13							1.16				1.29											1.1			1.085		2.18		
Residue on evaporation	mg/l				332				337							337				336										344					0.68			
Sampling Depth	m		nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm		
Selenium	µg/l															<0.5				<1.0										<1.0			<0.47					
Silver	µg/l															nm				nm																		
Sodium	mg/l	150			19.78				21.1							20.11				18.87											21			21.29		20.2		
Strontium	µg/l															226.68				222.14											230			224.2		253		
Sulphate	µg/l	50			4.9				4.8							5.1				5.86										4			4.69		<2	5.67		
Suspended Solids	mg/l																																			325		
Temp	°C		11.7	7.5	7.8	15	11.4	8.7	14	13.5	16.2	10.1	11.7	15	14.5	7	8.8	15.4	11.1	6.2	10.7	13.8	13	10.1	8.3	15.2	12.6				12.6				10.6	12.8	10.5	12.9
Thallium	µg/l															<0.1				<0.1																		
Time			12:15	11:4	11:55	10:25	12:20	12:35	10:45	10:10	10:20	10:30	10:25	10:45	11:00	10:25	10:10	nt	11:10	10:30	10:30	10:45	10:30	09:50	10:35	10:55	10:45											
Tin	µg/l															<1				nm																		
T.O.C.	mg/l N	10	<3.0	2.1	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	4.2	<1.5	7.7	<1.5	<1.5	<1.5	0.031	<1.5	1.5	<1.5	<1.5	2.4	<1.5	<1.5	<1.5	<1.5	<1.5	<1	1.84	0.5	<1			2.15	0.3	0.62	<3	
T.O.N	mg/l				0.26				0.46							0.37				0.21																0.4		
Total Suspended Solids	mg/l																																					
Uranium	µg/l															1.81				1.86											2			1.275		2.06		
Vanadium	µg/l															<0.5				<1.0										<1.0					<8			
Zinc	µg/l	100			2.6				4.9							1.9				2.74											1.6			10.52		<3		

PARAMETERS		Whiteriver Landfill Site GROUNDWATER QUALITY																																				
		RESULTS																																				
Monitoring Point:		B#6																																				
		DOWNSTREAM BEDROCK																																				
	Units	Trigger Level	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date		
Alkalinity	mg/lCaCO3	NAC			141					208					292																							
Aluminum	µg/l														<5																							
Ammonia	mg/l N	0.2	0.28	<0.03	<0.03	<0.03	<0.03	<0.03	0.06	0.03	0.03	0.03	<0.03	0.05	<0.03	0.112		0.03	<0.020	<0.020	<0.020	<0.020	0.046	0.064	<0.020	<0.020	<0.2	<0.11	0.014	<0.11	<0.11	<0.11	<0.1	<0.11	<0.11	<0.11		
Antimony	µg/l														<0.5																							
Arsenic	µg/l														0.73																							
Barium	µg/l														209.3																						403	
Beryllium	µg/l														<0.5																							
B.O.D.	mg/l O2																																					
Boron	µg/l	1000			32.5					61.3					60.3																						<135	
Cadmium	µg/l	5			<0.1					<0.1					<0.1																						<0.5	
Calcium	mg/l Ca	200			40.67					66.84					74.69																						77.9	
C.O.D.	mg/l O2									13.4																												
Chloride	mg/l Cl	20	10	13	7	8	9	7	13	16	16	14	14	15	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	
Chromium	µg/l	30			1.9					2.1					<0.5																						<3	
Cobalt	µg/l														<0.5																						<3	
Coliform Bacteria	no/100ml																																					
Conductivity	µS/cm @ 25	800	638	240	301	273	262	281	464	528	584	544	538	575	610	536	538		536	550	537	538	543	504	520	536	539	567	551	489	548		541	252.0	311	549		
Copper	µg/l	30			6.1				3.1						<0.5																						<4	
Cyanide	µg/l	0.01			<0.05				<0.05	35	59	43	58	42	60	42	63	39		33	27	28	65	66	43	49	67	57	7.07								<0.05	
D.O.	% Saturation		48	75	24	32	37	45	35	59	43	58	42	60	42	63	39		33	27	28	65	66	43	49	67	57	7.07								65		
E. Coli	no/100ml																																					
Fluoride	mg/l	1			<0.150				<0.150						<0.150																						0.818	
Iron	µg/l				1694				1983						<10																						0.895	
Lead	µg/l	10			6.9				1.8						<0.5																						<0.5	
Magnesium	mg/l Mg	50			8.86				15.58						16.46																						27.2	
Manganese	µg/l				425.7				59.7						252.3																						2080	
Mercury	µg/l	1			<0.1				<0.05						<0.05																					<0.02		
Molybdenum (µg/l)					3.6				16.7						0.8																					<5		
Nickel	µg/l	20			0.03				0.03						0.6																					2.86		
Ortho-Phosphate	mg/l P				0.03				0.03						0.04																						2.36	
pH	>7 or <8		7.5	7.5	7.5	7.4	7.6	7.6	7.6	7.6	7.7	7.5	7.8	7.8	7.7	7.5	7.8		7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.6	7.5	7.6	7.46	7.38	7.4	7.37	7.34	7.5	7.5	6.84
Potassium	mg/l	5			2.67				6.2						2.18																						2.66	
Residue on evaporation	mg/l				580				378						370																						1006	
Sampling Depth	m		13.8	13.9	13.3			13.9	13.8			13.9			0	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	
Selenium	µg/l														<0.5																					<0.5		
Silver	µg/l														nm																					nm		
Sodium	mg/l	150			7.98				21.44						14.82																						13.48	
Strontium	µg/l														199.45																						187.5	
Sulphate	µg/l	50			6				8.9						10.4																						11.04	
Suspended Solids	mg/l																																					
Temp	°C		12.3	10	10.3	11	10.9	9.3	11	15	14.6	10.9	11	13	14.5	6	8.9		11.6	9	9.8	14	11	8.5	10.2	14.6	13											
Thallium	µg/l														<0.1																					<0.1		
Time			12.5	12.35	13.2	11.3	13.15	13.45	12.20	12.00	12.25	11.20	11.20	11:30	12:00	11:15	13:00		12:20	11:45	11:50	11:25	11:45	11:45	11:25	12:30	11:20											
Tin	µg/l														<1																					nm		
T.O.C.	mg/l	10	8.2	43.3	19.8	47.1	36.2	5.9	3.4	12.3	4	3.3	68	2.2	2.4	3.4	1.3		5.7	9.4	3.1	6.4	4.2	3.9	2.1	3.6	2.5	2.95	2.21	1.27	1.39				5.71			
T.O.N	mg/l N				0.33				0.31						0.14																					0.04		
Total Suspended Solids	mg/l																																			0.84		
Uranium	µg/l														0.95																					1.26		
Vanadium	µg/l														<0.5																					<0.5		
Zinc	µg/l	100			14.6				12.2						10.4																					13.5		
Water Level m OD	105.01		91.21	91.11	91.71			91.11		91.2																												

PARAMETERS		Whiteriver Landfill Site GROUNDWATER QUALITY																																			
		RESULTS																																			
Monitoring Point:		BH14																																			
		DOWNSTREAM BEDROCK																																			
	Units	Trigger Level	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	
Alkalinity	mg/l CaCO3	NAC			356					352					332						332																
Aluminum	µg/l									<5					<5						<10.0																
Ammonia	mg/l N	0.2	<0.03	<0.03	<0.03	0.15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	0.03	0.12	0.04	<0.020	<0.020	<0.020	<0.020	0.14	<0.020	<0.020	<0.020	<0.2	<0.11	<0.11	<0.11	<0.11	<0.11	<0.1	<0.1	<0.1	<0.11	
Antimony	µg/l														<0.5						<0.5																
Arsenic	µg/l														<0.5																						
Barium	µg/l														145.4	147.41																					
Beryllium	µg/l														<0.5	<0.5																					
B.O.D.	mg/l O2																																				
Boron	µg/l	1000			30.7					29.7					36.6	30.43																					
Cadmium	µg/l	5			<0.1					<0.1					<0.1	<0.020	<0.1																				
Calcium	mg/l Ca	200			85.1					81.99					86.84																						
C.O.D.	mg/l O2									19.0																											
Chloride	mg/l Cl	20	15	15	16	18	17	16	20	17	15	13	17	17	16	16	18.38	14	15	15	15	13	15	15	15	16	15	17	12.8	14.3	14.23	13.6	13.8	14.5	14.6	15.2	15.7
Chromium	µg/l	30			<1					2.7					<0.5	0.65																					
Cobalt	µg/l														<0.5	<0.5																					
Coliform Bacteria	no/100ml																																				
Conductivity	µS/cm @ 25	800	645	653	654	645	584	661	647	635	725	661	657	722	773	663	652	672	645	658	663	663	676	631	643	630	646	672	678	571	648		676	501.0	506	661	
Copper	µg/l	30								1.9					1	1.15																					
Cyanide	µg/l	0.01			<0.05					<0.05					<0.05	<0.05																					
D.O.	% Saturation		39	53	52	nm	50	67	41	66	55	75	64	67	65	75	69	44	76	63	42	76	68	50	70	79	79	9.46						64	81.0	66	70
E. Coli	no/100ml																																				
Fluoride	mg/l	1			<0.150					<0.150					<0.150	0.15																					
Iron	µg/l				<10					2070.3					<10	18.47																					
Lead	µg/l	10			<1					1.5					<0.5	<0.5																					
Magnesium	mg/l Mg	50			24.12					26					20.71	21.86																					
Manganese	µg/l	1			324.7					111.3					2.3	6.22																					
Mercury	µg/l	1			<0.1					<0.05					<0.05	<0.05																					
Molybdenum (µg/l)	µg/l	20			<1					1.6					1.8	1.71																					
Nickel	µg/l	0.03			<1					0.99					<0.5	0.99																					
Ortho-Phosphate	mg/l P				<0.02					<0.02					0.02	0.017																					
pH		>7 or <8	7.5	7.4	7.4	7.4	7.5	7.7	7.4	7.5	7.5	7.5	7.6	7.6	7.5	7.5	7.5	7.4	7.5	7.4	7.4	7.4	7.8	7.5	7.6	7.4	7.4	7.44	7.36	7.3	7.61		7.33	7.5	7.4	7.21	
Potassium	mg/l	5			1.34					1.53					1.62	2.02																					
Residue on evaporation	mg/l				388					494					494	535																					
Sampling Depth	m		18.8	18.7	18.8	18.8	18.8			19	19.1	19.2	19.2		18.6	18.9	18.7	18.6																			
Selenium	µg/l														<0.5	<0.5																					
Silver	µg/l														nm	nm																					
Sodium	mg/l	150			24.79					22.69					26.84	25.55																					
Strontium	µg/l														226.93	234.58																					
Sulphate	µg/l	50			9.9					8.6					11.3	12.09																					
Suspended Solids	mg/l																																				
Temp	°C		11	8.1	11	11	11	9.6	10	13.5	nm	10	9	12	11	8	9.2	14.2	12	9	11.2	12	11	9.2	8.2	14.2	14.2							11.2	13.2	11.3	12.9
Thallium	µg/l														<1	<1																					
Time			11.2	10.55	11.2	10.35	11:15	10.45	10.50	10:20	10:20	10:45	10:35	10:30	10:50	10:30	10:35	10:15	10:25	10:25	11:00	10:45	10:45	10:20	10:25	10:30	09:55										
Tin	µg/l														<1	<1																					
T.O.C.	mg/l	10	<3.0	1.6	<1.5	<1.5	<1.5	4.6	<1.5	2.3	3.6	2.2	82	<1.5	2	<1.5	0.834	<1.5	2.3	1.8	1.7	3.5	2.4	2.7	2	2.3	2.3	2.89	3.25	2.83	2.05		3	0.8	0.73	<3	
T.O.N	mg/l N				0.13					<0.08					0.16	0.14																					
Total Suspended Solids	mg/l																																				
Uranium	µg/l														5.67	4.9																					
Vanadium	µg/l														<0.5	<0.5																					
Zinc	µg/l	100			5.3					4.8					2.7	2.7																					
Water Level m OD		98.98			80.18																																



Appendix D

Surface Water Monitoring Results

PARAMETERS		Whiteriver Landfill Site																										
		SURFACE WATER QUALITY																										
Monitoring Point:		RESULTS																										
		SW2A																										
Units	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	
Alkalinity	mg/lCaCO3	19-Jul-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12	09-Jan-13	09-Apr-13	08-Aug-13	17-Oct-13	14-Jan-14	11-Jun-14	15-Jul-14	14-Oct-14	19-Jan-15	16-Apr-15	05-Aug-15	19-Oct-15	24-Feb-16	11-May-16	20-Jul-16	27-Oct-16	14-Dec-16	23-Mar-17	14-Jun-17	8-Sep-17	14-Dec-17
					220				328													291.42	270	246				
Aluminium	µg/l				13.9				11.61													15.53	62.5	101				
Ammonia	mg/l N		0.1	0.03	0.05	5.84	0.16	0.41	0.314		0.25	1.3	0.037	0.054	0.046	0.6	0.36	0.05	0.092	0.399	0.87	0.041	< 0.11	< 0.11	<0.1	<0.1	<0.1	
Antimony	µg/l				<0.5				<0.5													<2.9	< 0.14					
Arsenic	µg/l				1.35				1.59													3.947						
Barium	µg/l				86.2				99.23													108.3	97.3				114	
Beryllium	µg/l				<0.5				<0.5																			
B.O.D.	mg/l O2		5.3	22.6	3.3	6.7	2.1	2.3	1.795		2.1	1.1	<2	<1.0	<1.0	<1.0	2.7	1.5	<1.0	1.47	8.31	<2	< 1	2.19	<2	<2	1.45	
Boron	µg/l				19.7				11.86													<5.1	<135				<135	
Cadmium	µg/l				<0.1				<0.1													<0.01					<0.5	
Calcium	mg/l Ca				90.03				100.24													109.6	<0.5				81.9	
C.O.D.	mg/l O2		36	59	23	68	24	29	16		36	91	34	30	<20	<20	<20	26	24	<25	99	<5	< 25	85.7	36	16	15	31
Chloride	mg/l Cl		48	47	37	35	31	37	52.91		46	45		35	31	28	32	25	31	24.9	24.9	25.41	20.5	<3	23.8	35	35	18.6
Chromium	µg/l				<0.5				<0.5													16.29					<3	
Cobalt	µg/l				<0.5				<0.5													<0.02					<3	
Coliform Bacteria	no/100ml																											
Conductivity	µS/cm @ 25		615	664	626	676	705	619	701		564	662	530	679	668	570	605	473	645	627	390	623	682		543	657	612	554
Copper	µg/l				2				1.24													1.746		<4			<4	
Cyanide	mg/l																										<0.05	
D.O.	% Saturation		93	67	88	85	66	101	116		92	75		77	76	73	112	84	87	9.4		90				92		94
E. Coli	no/100ml																											
Fluoride	mg/l																											
Iron	µg/l				58.9				78.71													225.5	0.193				0.189	
Lead	µg/l				<0.5				<0.5													<0.02	<0.5	<0.5			<0.5	
Magnesium	mg/l Mg				10.73				12.77													12.94	10.6				11.5	
Manganese	µg/l				134.2				223.38													150	18.4				12.7	
Mercury	µg/l				<0.05				<0.05													<0.03	<0.02				<0.02	
Molybdenum (µg/l)	µg/l				0.9				<0.5													<5					<5	
Nickel	µg/l				1.8				1.52													1.158	1.23				2.6	
Ortho-Phosphate	mg/l P				0.04				0.061								0.11					0.473	0.302				< 0.07	
pH			8.1	7.8	8.3	7.7	7.7	7.7	8.2		7.8	7.9	7.9	7.8	7.9	7.8	8.1	7.8	7.9	7.82	7.65	7.9	8.05		7.95	8	7.9	7.93
Potassium	mg/l				5.04				5.4													7.803	9.7				6.01	
Residue on evaporation																												
Sampling Depth	m																											
Selenium	µg/l				<0.5				<0.5													<0.54						
Silver	µg/l				nm				nm																			
Sodium	mg/l				20.34				24.57													17.28	14				11.8	
Strontium	µg/l				170.5				191.03													225.3					170	
Sulphate	mg/l SO4				55				31.83													31.18	34.9				34	
Suspended Solids	mg/l																											
Temp	°C		16.6	9.5	10.4	16.1	13.5	5	6.1		11.6	3.7	<2	<4	<4	<4	<4	6	6	3	97	5	< 3	17	3	2	5	
Thallium	µg/l				<0.1				<0.1																			
Time			12:15	11:45		11:45	11:35	11:50	11:15		11:25	11:15		nt	11:15	10:40	11:00	12:10	nt									
Tin	µg/l				<1				nm																			
T.O.C.	mg/l																											
T.O.N	mg/l N				1.42				0.8								0.67					0.61	1.55				0.62	
Total Suspended Solids	mg/l		40	10	19	10	7	11	13																			
Uranium	µg/l				1.24				1.26													<0.17					1.13	
Vanadium	µg/l				<0.5				<0.5																		<8	
Zinc	µg/l				2.4				3.83													6.567	5				3.33	

PARAMETERS		Whiteriver Landfill Site																											
		SURFACE WATER QUALITY																											
Monitoring Point:		RESULTS																											
		SW3																											
Units		Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
Alkalinity	mg/lCaCO3	19-Jul-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12	09-Jan-13	09-Apr-13	08-Aug-13	17-Oct-13	14-Jan-14	11-Jun-14	15-Jul-14	14-Oct-14	19-Jan-15	16-Apr-15	05-Aug-15	19-Oct-15	24-Feb-16	11-May-16	20-Jul-16	27-Oct-16	14-Dec-16	23-Mar-17	14-Jun-17	8-Sep-17	14-Dec-17	
Aluminium	µg/l				135				110													179.18		190					
Ammonia	mg/l N		0.04	<0.03	0.04	0.55	0.13	1.28	1.022		0.63	7.8	0.014		0.058	0.77	0.16			<0.2	0.14	<0.01	< 0.11	<0.11	< 0.11	0.136	<0.1	< 0.11	
Antimony	µg/l				0.56				1.33													<2.9	< 0.14						
Arsenic	µg/l				2.06				1.35													1.768		<2					
Barium	µg/l				66.1				84.34													85.54		92.2				139	
Beryllium	µg/l				<0.5				<0.5																				
B.O.D.	mg/l O2		<1.5	<1.5	3.7	3.8	<1.5	2	1.15		2	1.7	<2		<1.0	<1.0	<1.0			2.14	3.99	<2	< 1		2.01	<2	<2	1.43	
Boron	µg/l				30.3				21.81													171.7		<135				<135	
Cadmium	µg/l				<0.1				<0.1													0.055						<0.5	
Calcium	mg/l Ca				69.86				70.9													42.05		<0.5				85.2	
C.O.D.	mg/l O2		13	14	25	32	12	20	15		29	26	29		22	<20	<20			<25	29	15	< 25	67.4	28	33	28	26	
Chloride	mg/l Cl		18	21	22	27	19	32	29.55		42	42			15	10	10			9.7	7.34	9.49	7.43		9.57	9.4	10.2	10.4	
Chromium	µg/l				<0.5				<0.5													19.77		<3				<3	
Cobalt	µg/l				<0.5				1.05														<0.02						
Coliform Bacteria	no/100ml																												
Conductivity	µS/cm @ 25		599	506	515	518	601	563	502		680	677	382		462	486	417				456	325	356	473	484	336	352	579	
Copper	µg/l				2.3				2.08													9.159		<4				<4	
Cyanide	mg/l																											<0.05	
D.O.	% Saturation		nm	86	77	112	62	94	47		66	68			76	85	80			10		98			93		94		
E. Coli	no/100ml																												
Fluoride	mg/l																												
Iron	µg/l				20				20.85													179.7		0.0729				0.0449	
Lead	µg/l				<0.5				<0.5													0.221		<0.5				<0.5	
Magnesium	mg/l Mg				9.01				7.81													8.589		12.3				13	
Manganese	µg/l				68.7				949.3													51.11		42.6				10	
Mercury	µg/l				<0.05				<0.05													<0.03		<0.02				<0.02	
Molybdenum (µg/l)	µg/l				2.2				1.76														<5					<0.02	
Nickel	µg/l				2				3.54													0.491		1.81				2.3	
Ortho-Phosphate	mg/l P				<0.02				0.009								<0.010					<0.006		<0.02				< 0.07	
pH			7.8	8	8.2	8.2	8.2	7.9	7.7		7.5	7.8	7.8		7.7	8.1	7.9			8.05	7.66	7.7	7.5		7.61	7.5	7.5	7.65	
Potassium	mg/l				3.23				4.06													0.79		2.31				1.29	
Residue on evaporation																													
Sampling Depth	m																												
Selenium	µg/l				<0.5				<0.5													2.041							
Silver	µg/l				nm				nm																				
Sodium	mg/l				18.75				15.97													6.102		8.9				8.13	
Strontium	µg/l				171.79				167.78													142.9						213	
Sulphate	mg/l SO4				103.8				64.51													17.49		50.7				47.5	
Suspended Solids	mg/l																												
Temp	°C		14	7	10	17	11	7	5.3		11	<4	<2		11.5	1.9	10.6			5	10	11	10	18	9	8	<3.00		
Thallium	µg/l				<0.1				<0.1																			8.4	
Time			13:25	12:30	11:15	11:00	11:10	10:55	12:00		12:00	11:10			10:30	12:30	10:55											8.4	
Tin	µg/l				<1				nm																				
T.O.C.	mg/l																												
T.O.N	mg/l N				0.14				0.31													0.07		<0.1				< 0.08	
Total Suspended Solids	mg/l		<5	8	5	<5	<5	28	3																				
Uranium	µg/l				1.07				1.05													<0.17						1.6	
Vanadium	µg/l				<0.5				<0.5																			<8	
Zinc	µg/l				2.3				1.43													62.05		19.5				<3	

Appendix E

Gas Monitoring Results

23/01/2017			22/02/2017			24/03/2017			
CH4	CO2	O2	CH4	CO2	O2	CH4	CO2	O2	
PZ1	0	0.9	19.8 PZ1	0	1.2	19.5 PZ1	0	1.6	19
PZ2	0	1.2	19.3 PZ2	0	1.1	19.6 PZ2	0	1.1	19.5
PZ3	0	0	20.4 PZ3	0	0	20.6 PZ3	0	0.6	19.5
PZ4	0	0.9	19.4 PZ4	0	1.2	19.2 PZ4	0	0.6	19.8
PZ5	0	2.2	18.5 PZ5	0	1.9	18.7 PZ5	0	2.1	18.8
PZ54	0	0.8	19.5 PZ54	0	0.2	19.8 PZ54	0	0.7	19.4
PZ53	0	0	20.4 PZ53	0	0	20.6 PZ53	0	0	20.6
PZ52	0	0	20.4 PZ52	0	0	20.4 PZ52	0	0.2	20.2
PZ51	0	0	20.4 PZ51	0	0	20.4 PZ51	0	0	20.4
PZ50	0	0	20.4 PZ50	0	0	20.4 PZ50	0	0.2	20.4
PZ49	0	1.6	18.9 PZ49	0	1.6	18.9 PZ49	0	1.9	19.4
PZ48	0	0.2	19.2 PZ48	0	0	20.4 PZ48	0	0.9	20
PZ47	0	1.1	19.6 PZ47	0	0.2	19.8 PZ47	0	0.6	19.9
PZ46	0	2.2	18.3 PZ46	0	2.5	18.8 PZ46	0	2.5	18.4
PZ45	0	0.8	19.2 PZ45	0	0.7	20 PZ45	0	0.4	20
PZ44	0	0	20.4 PZ44	0	0	20.4 PZ44	0	0	20.4
PZ43	0	0	20.4 PZ43	0	0	20.4 PZ43	0	0	20.4
PZ42	0	0	20.4 PZ42	0	0.2	20.4 PZ42	0	0.5	20
PZ41	0	0	20.4 PZ41	0	0	20.6 PZ41	0	0.4	20.4
PZ40	0	0.2	20.2 PZ40	0	0	20.6 PZ40	0	0	20.6
PZ39	0	0	20.4 PZ39	0	0.2	20.4 PZ39	0	0.2	20.4
PZ38	0	0.2	20.2 PZ38	0	0.2	20.4 PZ38	0	0.2	20.4
PZ37	0	0	20.4 PZ37	0	0	20.6 PZ37	0	0.2	20.2
PZ36	0	1.1	19.4 PZ36	0	1.3	19.8 PZ36	0	1.3	19.8
PZ35	0	0.2	20.2 PZ35	0	0	20.4 PZ35	0	0.2	20.6
PZ34	0	0	20.2 PZ34	0	0.2	20.4 PZ34	0	0	20.4
PZ33	0	0	20.4 PZ33	0	0.2	20.4 PZ33	0	0.2	20.6
PZ32	0	0	20.4 PZ32	0	0	20.4 PZ32	0	0	20.4
PZ31	0	0	20.4 PZ31	0	0	20.4 PZ31	0	0.2	20.4
PZ30	0	0	20.4 PZ30	0	0.2	20.5 PZ30	0	0.2	20.4
PZ29	0	0	20.4 PZ29	0	0.2	20.5 PZ29	0	0.2	20.4
PZ28	0	1.6	18.8 PZ28	0	1.7	18.9 PZ28	0	2.2	1.86
PZ27	0	0	20.2 PZ27	0	0	20.5 PZ27	0	0.2	20.2
PZ26	0	0.9	19.3 PZ26	0	1.3	19.4 PZ26	0	1.2	19
PZ25	0	0	20.4 PZ25	0	0	20.6 PZ25	0	0.2	20.6
PZ24	0	0	20.4 PZ24	0	0	20.6 PZ24	0	0.2	20.6
PZ23	0	0	20.4 PZ23	0	0	20.6 PZ23	0	0.2	20.4
PZ22	0	0.2	20.2 PZ22	0	0	20.5 PZ22	0	0.2	20.4
PZ21	0	0	20.4 PZ21	0	0.2	20.2 PZ21	0	0	20.6
PZ11	0	1.2	19.5 PZ11	0	1.4	19.2 PZ11	0	1.3	19.5
PZ12	0	0	20.4 PZ12	0	0.2	20.4 PZ12	0	0.2	20.4
PZ13	0	0.2	20.4 PZ13	0	0.2	20.5 PZ13	0	0.2	20.2
PZ14	0	0	20.4 PZ14	0	0.2	20.4 PZ14	0	0.2	20.4
PZ15	0	0.2	20.4 PZ15	0	0.2	20.5 PZ15	0	0.2	20.4
PZ16	0	0.9	19.6 PZ16	0	1.1	19.5 PZ16	0	1	19.8

20/04/2017

25/05/2017

23/06/2017

20/04/2017			25/05/2017			23/06/2017					
CH4	CO2	O2	CH4	CO2	O2	CH4	CO2	O2			
PZ1	0	1.1	19.6	PZ1	0	1.6	18.8	PZ1	0	1.7	18.8
PZ2	0	1.2	19.4	PZ2	0	1	19.4	PZ2	0	1.2	19.2
PZ3	0	0	20.8	PZ3	0	0.4	19.4	PZ3	0	0.2	20
PZ4	0	1	19.4	PZ4	0	0.5	18.8	PZ4	0	0.2	20.2
PZ5	0	2	18.6	PZ5	0	1.7	18.4	PZ5	0	1.9	18.8
PZ54	0	0	20.6	PZ54	0	0.6	19.6	PZ54	0	0.5	19.8
PZ53	0	0	20.6	PZ53	0	0	20.6	PZ53	0	0	20.6
PZ52	0	0	20.4	PZ52	0	0	20.6	PZ52	0	0	20.4
PZ51	0	0	20.6	PZ51	0	0	20.4	PZ51	0	0	20.4
PZ50	0	0	20.4	PZ50	0	0	20.6	PZ50	0	0.2	20.4
PZ49	0	1.5	18.8	PZ49	0	1.6	18.5	PZ49	0	1.7	19.6
PZ48	0	0	20.4	PZ48	0	0.6	19.4	PZ48	0	0.8	20.2
PZ47	0	0	20.4	PZ47	0	0.8	19.2	PZ47	0	0.4	20
PZ46	0	2.6	18.6	PZ46	0	2.3	18.2	PZ46	0	2.2	18.2
PZ45	0	0.5	19.8	PZ45	0	0.2	20	PZ45	0	0.2	20.2
PZ44	0	0	20.4	PZ44	0	0	20.6	PZ44	0	0	20.4
PZ43	0	0	20.4	PZ43	0	0	20.6	PZ43	0	0	20.4
PZ42	0	0	20.6	PZ42	0	0.3	20.1	PZ42	0	0.2	20.2
PZ41	0	0	20.6	PZ41	0	0.2	20.2	PZ41	0	0.4	20.4
PZ40	0	0	20.6	PZ40	0	0	20.6	PZ40	0	0	20.6
PZ39	0	0	20.4	PZ39	0	0	20.4	PZ39	0	0	20.4
PZ38	0	0.2	20.4	PZ38	0	0	20.4	PZ38	0	0	20.4
PZ37	0	0	20.6	PZ37	0	0.2	20.2	PZ37	0	0	20.6
PZ36	0	1.4	19.6	PZ36	0	1.4	19.6	PZ36	0	1.5	19.2
PZ35	0	0	20.4	PZ35	0	0.2	20.6	PZ35	0	0	20.6
PZ34	0	0.2	20.4	PZ34	0	0	20.4	PZ34	0	0	20.4
PZ33	0	0	20.4	PZ33	0	0	20.4	PZ33	0	0.2	20.6
PZ32	0	0	20.4	PZ32	0	0	20.4	PZ32	0	0	20.4
PZ31	0	0	20.4	PZ31	0	0.2	20.4	PZ31	0	0	20.6
PZ30	0	0.2	20.5	PZ30	0	0	20.4	PZ30	0	0.2	20.6
PZ29	0	0	20.5	PZ29	0	0.2	20.4	PZ29	0	0.2	20.4
PZ28	0	1.8	18.8	PZ28	0	1.9	18.4	PZ28	0	1.9	18.2
PZ27	0	0	20.5	PZ27	0	0.2	20.2	PZ27	0	0	20.6
PZ26	0	1.1	19	PZ26	0	1.2	19	PZ26	0	1.2	19
PZ25	0	0	20.6	PZ25	0	0	20.6	PZ25	0	0	20.6
PZ24	0	0	20.6	PZ24	0	0	20.6	PZ24	0	0	20.6
PZ23	0	0	20.6	PZ23	0	0	20.4	PZ23	0	0.2	20.4
PZ22	0	0	20.5	PZ22	0	0.2	20.4	PZ22	0	0	20.6
PZ21	0	0	20.2	PZ21	0	0	20.6	PZ21	0	0	20.6
PZ11	0	1.3	19	PZ11	0	1.5	19.2	PZ11	0	1.4	19.2
PZ12	0	0	20.4	PZ12	0	0	20.4	PZ12	0	0	20.4
PZ13	0	0.2	20.5	PZ13	0	0.2	20.2	PZ13	0	0.2	20.2
PZ14	0	0.2	20.4	PZ14	0	0	20.4	PZ14	0	0.2	20.4
PZ15	0	0	20.5	PZ15	0	0.2	20.4	PZ15	0	0.2	20.4
PZ16	0	1.1	19.6	PZ16	0	0.1	19.6	PZ16	0	0.8	19.6

12/07/2017

21/08/2017

08/09/2017

12/07/2017			21/08/2017			08/09/2017					
CH4	CO2	O2	CH4	CO2	O2	CH4	CO2	O2			
PZ1	0	1.6	18.8	PZ1	0	1.5	18.2	PZ1	0	1.1	19.6
PZ2	0	1.1	19.4	PZ2	0	1	19.2	PZ2	0	1.6	18.2
PZ3	0	0.2	20.2	PZ3	0	0.2	19.2	PZ3	0	0	20.4
PZ4	0	0.2	20.2	PZ4	0	0.5	18.6	PZ4	0	0.7	19.2
PZ5	0	1.8	18.6	PZ5	0	1.5	18.8	PZ5	0	1.8	18.6
PZ54	0	0.6	19.6	PZ54	0	0.4	19.5	PZ54	0	0.4	19.4
PZ53	0	0	20.6	PZ53	0	0	20.6	PZ53	0	0	20.4
PZ52	0	0	20.6	PZ52	0	0	20.6	PZ52	0	0	20.4
PZ51	0	0	20.6	PZ51	0	0	20.6	PZ51	0	0	20.4
PZ50	0	0.2	20.6	PZ50	0	0	20.6	PZ50	0	0	20.4
PZ49	0	1.5	20	PZ49	0	1.7	18.2	PZ49	0	1.5	19
PZ48	0	1.1	20	PZ48	0	0.4	19.2	PZ48	0	0	20.2
PZ47	0	0.4	20	PZ47	0	0.4	19	PZ47	0	1	20
PZ46	0	2.1	18.2	PZ46	0	2.2	18.2	PZ46	0	1.7	18.2
PZ45	0	0	20.2	PZ45	0	0	20.6	PZ45	0	0.8	19.2
PZ44	0	0	20.4	PZ44	0	0	20.6	PZ44	0	0	20.4
PZ43	0	0	20.4	PZ43	0	0	20.6	PZ43	0	0	20.4
PZ42	0	0.2	20.2	PZ42	0	0.2	20.1	PZ42	0	0	20.4
PZ41	0	0.4	20.4	PZ41	0	0.2	20.2	PZ41	0	0	20.4
PZ40	0	0	20.6	PZ40	0	0	20.6	PZ40	0	0	20.4
PZ39	0	0	20.4	PZ39	0	0	20.4	PZ39	0	0	20.4
PZ38	0	0	20.4	PZ38	0	0	20.4	PZ38	0	0.2	20.2
PZ37	0	0	20.6	PZ37	0	0.2	20.2	PZ37	0	0	20.4
PZ36	0	1.6	18.6	PZ36	0	1.4	19.6	PZ36	0	1.2	19.6
PZ35	0	0	20.6	PZ35	0	0.2	20.6	PZ35	0	0.4	20
PZ34	0	0	20.4	PZ34	0	0	20.4	PZ34	0	0	20.2
PZ33	0	0	20.6	PZ33	0	0	20.4	PZ33	0	0	20.4
PZ32	0	0	20.4	PZ32	0	0	20.4	PZ32	0	0	20.4
PZ31	0	0	20.6	PZ31	0	0.2	20.4	PZ31	0	0	20.4
PZ30	0	0.2	20.6	PZ30	0	0	20.4	PZ30	0	0	20.4
PZ29	0	0.2	20.4	PZ29	0	0.2	20.4	PZ29	0	0	20.4
PZ28	0	1.7	18.4	PZ28	0	1.7	18.2	PZ28	0	1.7	18.4
PZ27	0	0	20.6	PZ27	0	0	20.2	PZ27	0	0	20.2
PZ26	0	1.3	18.5	PZ26	0	1.6	18.2	PZ26	0	0.6	19.1
PZ25	0	0	20.6	PZ25	0	0	20.6	PZ25	0	0	20.4
PZ24	0	0	20.6	PZ24	0	0	20.6	PZ24	0	0	20.4
PZ23	0	0	20.4	PZ23	0	0	20.4	PZ23	0	0	20.4
PZ22	0	0	20.6	PZ22	0	0	20.6	PZ22	0	0.2	20.2
PZ21	0	0	20.6	PZ21	0	0	20.6	PZ21	0	0	20.4
PZ11	0	1.6	18.2	PZ11	0	1.6	19	PZ11	0	1.1	19.8
PZ12	0	0	20.4	PZ12	0	0	20.4	PZ12	0	0	20.4
PZ13	0	0	20.2	PZ13	0	0	20.2	PZ13	0	0	20.4
PZ14	0	0.2	20.4	PZ14	0	0	20.4	PZ14	0	0	20.4
PZ15	0	0.2	20.4	PZ15	0	0.2	20.4	PZ15	0	0.2	20.4
PZ16	0	0.8	19.6	PZ16	0	0	19.6	PZ16	0	0.8	19.8

20/10/2017			23/11/2017			14/12/2017						
	CH4	CO2	O2		CH4	CO2	O2		CH4	CO2	O2	
PZ1	0		0.7	20.2	PZ1	0	1.4	19.2	PZ1	0	1.2	19.2
PZ2	0		1.1	19.2	PZ2	0	1.1	19.4	PZ2	0	1.1	19.6
PZ3	0		0	20.4	PZ3	0	0.2	20.2	PZ3	0	0	20.6
PZ4	0		0.9	19.4	PZ4	0	0.2	20.2	PZ4	0	1.2	19.2
PZ5	0		2.1	18.5	PZ5	0	1.8	18.6	PZ5	0	1.9	18.7
PZ54	0		0.8	19.5	PZ54	0	0.6	19.6	PZ54	0	0.2	19.8
PZ53	0		1.2	18.7	PZ53	0	0	20.6	PZ53	0	1.5	18.7
PZ52	0		1.2	20.2	PZ52	0	0	20.6	PZ52	0	0	20.4
PZ51	0		0	20.4	PZ51	0	0	20.6	PZ51	0	0	20.4
PZ50	0		0	20.4	PZ50	0	0.2	20.6	PZ50	0	0	20.4
PZ49	0		2.1	18.9	PZ49	0	1.5	20	PZ49	0	1.4	18.9
PZ48	0		0.2	19.2	PZ48	0	1.1	20	PZ48	0	0	20.4
PZ47	0		1.4	21.2	PZ47	0	0.4	20	PZ47	0	0.2	19.8
PZ46	0		2.2	18.3	PZ46	0	2.1	18.2	PZ46	0	2.5	18.8
PZ45	0		0.8	19.2	PZ45	0	0	20.2	PZ45	0	0.7	20
PZ44	0		0	20.4	PZ44	0	0	20.4	PZ44	0	0	20.4
PZ43	0		0	20.4	PZ43	0	0	20.4	PZ43	0	0	20.4
PZ42	0		0	20.4	PZ42	0	0.2	20.2	PZ42	0	0.2	20.4
PZ41	0		0	20.4	PZ41	0	1.2	20.6	PZ41	0	1.2	20.6
PZ40	0		0.2	20.2	PZ40	0	1.4	20.4	PZ40	0	0	20.6
PZ39	0		0	20.4	PZ39	0	0	20.4	PZ39	0	1.9	21.5
PZ38	0		0.2	20.2	PZ38	0	0	20.4	PZ38	0	0.2	20.4
PZ37	0		0	20.4	PZ37	0	0	20.6	PZ37	0	0	20.6
PZ36	0		1.1	19.4	PZ36	0	1.6	18.6	PZ36	0	1.3	19.8
PZ35	0		0.2	20.2	PZ35	0	0	20.6	PZ35	0	0	20.4
PZ34	0		0	20.2	PZ34	0	0	20.4	PZ34	0	0.2	20.4
PZ33	0		0	20.4	PZ33	0	0	20.6	PZ33	0	0.2	20.4
PZ32	0		0	20.4	PZ32	0	0	20.4	PZ32	0	0	20.4
PZ31	0		0	20.4	PZ31	0	0	20.6	PZ31	0	0	20.4
PZ30	0		0	20.4	PZ30	0	0.2	20.6	PZ30	0	0.2	20.5
PZ29	0		0	20.4	PZ29	0	0.2	20.4	PZ29	0	0.2	20.5
PZ28	0		1.6	18.8	PZ28	0	1.7	19.4	PZ28	0	1.7	18.9
PZ27	0		0	20.2	PZ27	0	0	20.6	PZ27	0	0	20.5
PZ26	0		0.9	19.3	PZ26	0	1.3	18.5	PZ26	0	1.3	19.4
PZ25	0		0	20.4	PZ25	0	0	20.6	PZ25	0	0	20.6
PZ24	0		0	20.4	PZ24	0	0	20.6	PZ24	0	0	20.6
PZ23	0		0	20.4	PZ23	0	0	20.4	PZ23	0	0	20.6
PZ22	0		0.2	20.2	PZ22	0	0	20.6	PZ22	0	0	20.5
PZ21	0		0	20.4	PZ21	0	0	20.6	PZ21	0	0.2	20.2
PZ11	0		1.2	19.5	PZ11	0	1.2	19.2	PZ11	0	1.4	19.2
PZ12	0		0	20.4	PZ12	0	0	20.4	PZ12	0	0.2	20.4
PZ13	0		0.2	20.4	PZ13	0	0	20.2	PZ13	0	0.2	20.5
PZ14	0		0	20.4	PZ14	0	0.2	20.4	PZ14	0	0.2	20.4
PZ15	0		0.2	20.4	PZ15	0	0.2	20.4	PZ15	0	0.2	20.5
PZ16	0		0.9	19.6	PZ16	0	0.8	19.6	PZ16	0	2.9	17.9

Appendix F

Water Balance Calculation

MONTHLY WATER BALANCE CALCULATION 2017

	Active Phase	Active Area A(m2)	Waste Input t/month	Rainfall mm	Active Area Infiltration AR(A)(m3)	Liquid Waste LW(m3) Excess Water From Sludge	Temp Restored area	Temp Restored area(Temp) RCA(m2)	Restored area(Temp) infiltration IRCA(m3)	Leachate Lagoon AR(l)	Permanently Restored area	Permanently Restored area	Restored area RCA(m2)	Total Water	Cumulative Water	Absorptive Capacity aW(m3)	Cumulative Absorptive Capacity	Cumulative Leachate	Leachate produced Lo(m3)	Leachate tankered to WWTP
January	leachate lagoon	1,600		21.9				0	35	Whole site	129806		284	319	319	0.00	0.00	319	319	247
February	leachate lagoon	1,600		41.6				0	67	Whole site	129806		540	607	926	0.00	0.00	926	607	125
March	leachate lagoon	1,600		67.2				0	108	Whole site	129806		872	980	1906	0.00	0.00	1906	980	1289
April	leachate lagoon	1,600		10.0				0	16	Whole site	129806		130	146	2051	0.00	0.00	2051	146	908
May	leachate lagoon	1,600		43.5				0	70	Whole site	129806		565	634	2686	0.00	0.00	2686	634	243
June	leachate lagoon	1,600		86.4				0	138	Whole site	129806		1122	1260	3946	0.00	0.00	3946	1260	608
July	leachate lagoon	1,600		42.2				0	68	Whole site	129806		548	615	4561	0.00	0.00	4561	615	242
August	leachate lagoon	1,600		73.2				0	117	Whole site	129806		950	1067	5628	0.00	0.00	5628	1067	158
September	leachate lagoon	1,600		82.3				0	132	Whole site	129806		1068	1200	6828	0.00	0.00	6828	1200	640
October	leachate lagoon	1,600		47.8				0	76	Whole site	129806		620	697	7525	0.00	0.00	7525	697	1256
November	leachate lagoon	1,600		81.5				0	130	Whole site	129806		1058	1188	8713	0.00	0.00	8713	1188	547
December	leachate lagoon	1,600		63.1				0	101	Whole site	129806		819	920	9633	0.00	0.00	9633	920	958
Total				660.7				0	1057				8576	9633		0		9633	7223	

Assumptions

IRCA	Temporarily capped/restored area infiltration of rainfall estimated %	30%	%
	Permanent capped/restored area infiltration of rainfall estimated %	10%	%
Absorptive Capacity	waste density of 0.8 tonnes/m3. Estimated absorptive capacity (water per tonne waste before leachate is produced) t/m3	0.06	t/m3
Landfill areas/cells	Area of landfill site restored (1,2)	41,000	m ²
	Area of Phase 3	11,500	m ²
	Area of Phase 1,2 and 3 remaining to be temp capped	7,000	m ²
	Area of Phase 4, Cell 1A	2,190	m ²
	Area of Phase 4, Cell 1	15,000	m ²
	Area of Phase 4, Cell 2	8,000	m ²
	Area of Phase 5, Cell 3A	7,974	m ²
	Area of Phase 5, Cell 3B	7,180	m ²
	Area of Phase 5, Cell 2A	13,761	m ²
	Area of Phase 5, Cell 2B	5,795	m ²
	Area of Phase 5, Cell 1A	10,083	m ²
	Area of Phase 5, Cell 1B	323	m ²
	Surface Area Leachate Lagoon	1,600	m ²
Rainfall	Rainfall taken from Dublin Airport	660.7	mm

Appendix G

Estimated Annual Gas Yield

A survey of landfill sites to determine the quantity of methane flared and or recovered in utilisation plants for 2017

Please choose from the drop down menu the license number for your site	<input type="text" value="W0060"/>
Please choose from the drop down menu the name of the landfill site	<input type="text" value="Whiteriver Landfill Site"/>
Please enter the number of flares operational at your site in 2017	<input type="text" value="1"/>
Please enter the number of engines operational at your site in 2017	<input type="text" value="2"/>
Total methane flared	<input type="text" value="1,321"/> kg/year
Total methane utilised in engines	<input type="text" value="737,405"/> kg/year

Please note that the closing date for receipt of completed surveys is 31/03/2018

Introduction

The Office of Environmental Sustainability (OES) of the Environmental Protection Agency acts as the inventory agency in Ireland with responsibility for compiling and reporting national greenhouse gas inventories to the European Commission and the United Nations Framework Convention on Climate Change. In addition to meeting international commitments Ireland's national greenhouse gas inventory informs national agencies and Government departments as they face the challenge to curb emissions and meet Ireland's emission reduction targets under the Effort Sharing Decision (No. 406/2009/EC). The national inventory also informs data suppliers, making them aware of the importance of their contributions to the inventory process and a means of identifying areas where input data may be improved.

It is on this basis that the Environmental Protection Agency is asking landfill operators to partake in this survey so that the most up to date information on methane flaring and recovery in utilisation plants at landfill sites is used in calculating the contribution of the landfill sector to national greenhouse gas emissions

The Environmental Protection Agency wishes to thank you for partaking in this survey. If you have any questions about the survey and how to complete it please view the "Help sheet" worksheet. If however, your query is not answered by viewing the "Help sheet" worksheet please contact:

LFGProject@epa.ie

Once completed please send the completed file as an attachment clearly stating the name and or license number of the landfill site (e.g. W000 Xanadu landfill_2017) to:

LFGProject@epa.ie

to be filled in by licensee calculated by spreadsheet

Flare No. 1

Flare type ? If "other" enter flare description here

Is the flare an open or enclosed flare ? Rated flare capacity ? m3/hr

Month /year commissioned ?

Month decommissioned if decommissioned in 2017 ?

What is the function of the flare ? If "other" enter flare function here

Monthly	Method M/C/E	Runtime days/month	Runtime hrs/day	Downtime hrs	Total runtime hrs/month	Average Inlet Pressure (mbg)	Average Inlet Temp ° C	Average Flow Rate (m ³ /hr)	Average CH ₄ %v/v	Average CO ₂ %v/v	Average O ₂ %v/v	Combustion efficiency (%)	Total CH ₄ m ³	Total CH ₄ kgs
January	MCE	1	4.0	0.0	4	10	10	250	49.40	29.10	1.00	98.0	484	338
February					0	Select	10					98.0	0	#N/A
March					0	Select	10					98.0	0	#N/A
April	MCE	1	4.0	0.0	4	10	10	250	48.50	29.50	1.00	98.0	475	331
May					0	Select	10					98.0	0	#N/A
June					0	Select	10					98.0	0	#N/A
July					0	Select	10					98.0	0	#N/A
August	MCE	1	4.0	0.0	4	10	10	250	48.60	28.40	10.00	98.0	476	332
September					0	Select	10					98.0	0	#N/A
October					0	Select	10					98.0	0	#N/A
November	MCE	1	4.0	0.0	4	10	10	250	46.80	27.40	1.00	98.0	459	320
December					0	Select	10					98.0	0	#N/A
Total					16								1,894	1,321

Please note: Only fill the "Yearly" table if data is not available or cannot be calculated nor estimated on a monthly basis

Yearly	Method M/C/E	Runtime days/year	Runtime hrs/day	Downtime hrs	Total runtime hrs/year	Average Inlet Pressure (mbg)	Average Inlet Temp ° C	Average Flow Rate m ³ /hr	Average CH ₄ %v/v	Average CO ₂ %v/v	Average O ₂ %v/v	Combustion efficiency (%)	Total CH ₄ m ³	Total CH ₄ kgs
2017					0		10					98.0	0	0

to be filled in by licensee calculated by spreadsheet

Flare No. 2

Flare type ? If "other" enter flare description here

Is the flare an open or enclosed flare ? Rated flare capacity ? m3/hr

Month /year comissioned ?

Month decomissioned if decomissioned in 2017 ?

What is the function of the flare ? If "other" enter flare function here

Monthly	Method M/C/E	Runtime days/month	Runtime hrs/day	Downtime hrs	Total runtime hrs/month	Average Inlet Pressure (mbg)	Average Inlet Temp ° C	Average Flow Rate (m ³ /hr)	Average CH ₄ %v/v	Average CO ₂ %v/v	Average O ₂ %v/v	Combustion efficiency (%)	Total CH ₄ m ³	Total CH ₄ kgs
January					0	Select	10					98.0	0	#N/A
February					0	Select	10					98.0	0	#N/A
March					0	Select	10					98.0	0	#N/A
April					0	Select	10					98.0	0	#N/A
May					0	Select	10					98.0	0	#N/A
June					0	Select	10					98.0	0	#N/A
July					0	Select	10					98.0	0	#N/A
August					0	Select	10					98.0	0	#N/A
September					0	Select	10					98.0	0	#N/A
October					0	Select	10					98.0	0	#N/A
November					0	Select	10					98.0	0	#N/A
December					0	Select	10					98.0	0	#N/A
Total					0								0	0

Please note: Only fill the "Yearly" table if data is not available or cannot be calculated nor estimated on a monthly basis

Yearly	Method M/C/E	Runtime days/year	Runtime hrs/day	Downtime hrs	Total runtime hrs/year	Average Inlet Pressure (mbg)	Average Inlet Temp ° C	Average Flow Rate m ³ /hr	Average CH ₄ %v/v	Average CO ₂ %v/v	Average O ₂ %v/v	Combustion efficiency (%)	Total CH ₄ m ³	Total CH ₄ kgs
2017					0		10					98.0	0	0

to be filled in by licensee	calculated by spreadsheet
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Engine No. 1	
Engine type ?	Other <input type="text"/> MWM 800 KW ENGINE
Month /year comissioned ?	July <input type="text"/> 2014 <input type="text"/>
Month decomissioned if decomissioned in 2017 ?	Select <input type="text"/>

Monthly	Method M/C/E	Runtime days/month	Runtime hrs/day	Downtime hrs	Total runtime hrs/month	Average Inlet Pressure (mbg)	Average Inlet Temp ° C	Average Flow Rate (m ³ /hr)	Average CH ₄ %v/v	Average CO ₂ %v/v	Average O ₂ %v/v	Combustion efficiency (%)	Total CH ₄ m ³	Total CH ₄ kgs
January	MCE	12	24	0	288	90	10	300	49.40	29.10	1.00	98.0	41,828	31,445
February	MCE	21	24	0	504	90	10	300	48.70	30.50	1.00	98.0	72,162	54,250
March	MCE	21	24	0	504	90	10	300	49.20	28.60	1.00	98.0	72,903	54,807
April	MCE	11	24	0	264	90	10	270	48.50	29.50	1.00	98.0	33,879	25,470
May	MCE	2	24	0	48	90	10	270	49.20	28.60	1.00	98.0	6,249	4,698
June	MCE	4	24	0	96	90	10	270	46.80	29.10	1.00	98.0	11,888	8,937
July	MCE	2	24	0	48	90	10	270	45.60	27.40	1.00	98.0	5,792	4,354
August	MCE	9	24	0	216	90	10	270	48.60	28.40	1.00	98.0	27,777	20,882
September	MCE	18	24	0	432	90	10	270	46.20	27.40	1.00	98.0	52,810	39,701
October	MCE	19	24	0	456	90	10	270	47.10	28.40	1.00	98.0	56,830	42,723
November	MCE	0	24	0	0	90	10	250	46.80	27.40	1.00	98.0	0	0
December	MCE	4	24	0	96	90	10	250	47.20	28.40	1.00	98.0	11,101	8,346
Total					2,952								393,218	295,612

Please note: Only fill the "Yearly" table if data is not available or cannot be calculated nor estimated on a monthly basis

Yearly	Method M/C/E	Runtime days/year	Runtime hrs/day	Downtime hrs	Total runtime hrs/year	Average Inlet Pressure (mbg)	Average Inlet Temp ° C	Average Flow Rate m ³ /hr	Average CH ₄ %v/v	Average CO ₂ %v/v	Average O ₂ %v/v	Combustion efficiency (%)	Total CH ₄ m ³	Total CH ₄ kgs
2017					0	Select	10					98.0	0	0

to be filled in by licensee	calculated by spreadsheet	
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Engine No. 2	
Engine type ?	Other <input type="text"/> MWM 600 KW ENGINE
Month /year comissioned ?	July <input type="text"/> 2014 <input type="text"/>
Month decomissioned if decomissioned in 2017 ?	Select <input type="text"/>

Monthly	Method M/C/E	Runtime days/month	Runtime hrs/day	Downtime hrs	Total runtime hrs/month	Average Inlet Pressure (mbg)	Average Inlet Temp ° C	Average Flow Rate (m ³ /hr)	Average CH ₄ %v/v	Average CO ₂ %v/v	Average O ₂ %v/v	Combustion efficiency (%)	Total CH ₄ m ³	Total CH ₄ kgs
January	MCE	18	24	0	432	90	10	250	49.40	29.10	1.00	98.0	52,285	39,307
February	MCE	3	24	0	72	90	10	250	48.70	30.50	1.00	98.0	8,591	6,458
March	MCE	9	24	0	216	90	10	250	49.20	28.60	1.00	98.0	26,037	19,574
April	MCE	18	24	0	432	90	10	250	48.50	29.50	1.00	98.0	51,332	38,591
May	MCE	27	24	0	648	90	10	250	49.20	28.60	1.00	98.0	78,110	58,721
June	MCE	25	24	0	600	90	10	250	46.80	29.10	1.00	98.0	68,796	51,719
July	MCE	27	24	0	648	90	10	250	45.60	27.40	1.00	98.0	72,395	54,425
August	MCE	21	24	0	504	90	10	230	48.60	28.40	1.00	98.0	55,210	41,506
September	MCE	12	24	0	288	90	10	230	46.20	27.40	1.00	98.0	29,991	22,546
October	MCE	7	24	0	168	90	10	230	47.10	28.40	1.00	98.0	17,835	13,408
November	MCE	27	24	0	648	90	10	230	46.80	27.40	1.00	98.0	68,356	51,388
December	MCE	23	24	0	552	90	10	230	47.20	28.40	1.00	98.0	58,727	44,149
Total					5,208								587,664	441,793

Please note: Only fill the "Yearly" table if data is not available or cannot be calculated nor estimated on a monthly basis

Yearly	Method M/C/E	Runtime days/year	Runtime hrs/day	Downtime hrs	Total runtime hrs/year	Average Inlet Pressure (mbg)	Average Inlet Temp ° C	Average Flow Rate m ³ /hr	Average CH ₄ %v/v	Average CO ₂ %v/v	Average O ₂ %v/v	Combustion efficiency (%)	Total CH ₄ m ³	Total CH ₄ kgs
2017					0		10					98.0	0	0